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SAMPLING AND ANALYSIS PLAN OPERABLE UNIT 2 WORK PLAN ADDENDUM - (MARCH SUBMITTAL - DRAFT 1)

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Mr. James A. Saric, Remedial Project Director
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Region V - 5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Graham E. Mitchell, Project Manager
Ohio Environmental Protection Agency
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Dear Mr. Saric and Mr. Mitchell:

SAMPLING AND ANALYSIS PLAN OPERABLE UNIT 2 WORK PLAN ADDENDUM

This letter transmits the Department of Energy (DOE) proposed Sampling and Analysis Plan (SAP) for the Operable Unit (OU) 2 Work Plan Addendum. The sitewide Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ) requires that a Project Specific Plan (PSP) be developed for each project that includes environmental sampling and analysis. This SAP fulfills all the requirements of the PSP.

This SAP was developed based upon comments received from the United States Environmental Protection Agency (U.S. EPA) and Ohio Environmental Protection Agency (OEPA) pertaining to the OU 2 Draft RI Report.

As discussed at recent meetings, the U.S. EPA and OEPA have indicated they would conduct an expedited review of the document in hope of allowing DOE to maintain its aggressive schedule. In addition, DOE plans to initiate work under this proposed plan prior to U.S. EPA and OEPA approval, based upon our discussions at recent meetings during which verbal approval was obtained for specific field activities.

If you or your staff have any questions, please contact Johnny Reising at 513-738-9083.

Sincerely,

Jack R. Craig
Fernald Remedial Action
Project Manager

FN:Reising

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SAMPLING AND ANALYSIS PLAN FOR RI/FS WORK PLAN ADDENDUM OPERABLE UNIT 2

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

MARCH 1993

WBS # 20.03.05

U.S. DEPARTMENT OF ENERGY
FERNALD SITE OFFICE

DRAFT 1

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1.0 INTRODUCTION

The Fernald Environmental Management Project (FEMP) is owned by the U.S. Department of Energy (DOE) and is a former uranium processing facility. The current mission of the FEMP is waste management and environmental restoration; and, as such, it is subject to a wide range of environmental statutes and regulations.

The Remedial Investigation (RI) Report for Operable Unit 2 (OU 2) was submitted by the Department of Energy (DOE) to the U.S. EPA and Ohio EPA in October 1992. Based on review comments from the U.S. and Ohio EPAs on the RI Report (December 17, 1992), and responses to those comments submitted by DOE (February 7, 1993), a second phase of RI sampling and analysis is required for OU 2 in order to meet the objectives of the Sitewide RI/FS Work Plan (March 1988).

Collection and analysis of environmental samples is an integral part of the OU 2 RI/FS. This Sampling and Analysis Plan (SAP) has been prepared in accordance with CERCLA Guidance for Conducting Remedial Investigations and Feasibility Studies.

1.1 PURPOSE

A SAP is required to provide project specific planning and QA/QC guidance for environmental sampling and analysis. This SAP is written in a form which is to be used on a day-to-day basis by FEMP project personnel, and it will guide field personnel to gather the samples and field information required to meet the project specific data quality objectives (DQOs).

Designation of the FEMP as a Superfund site in 1989, and inclusion on the National Priorities List (NPL), resulted in a decision to revise the existing Remedial Investigation/Feasibility Study Quality Assurance Project Plan (QAPjP). Subsequently, the Sitewide CERCLA Quality Assurance Project Plan (SCQ) was developed in 1992 to direct environmental sampling and analysis to support ultimate remediation of the site. The SCQ requires that a Project Specific Plan (PSP) be developed for each project performed at the FEMP that includes environmental sampling and analyses. Section 3.3.2 of the SCQ identifies six major aspects of the project which must be addressed in the SAP such that the SAP fulfills the requirements for a PSP. These aspects are listed below along with references to appropriate section of the SAP:

- Project Background - Section 2.0
- Project Objectives - Section 3.0
- Project Organization - Section 4.0

- Sample Design - Sample 8.0
- Analytical Methods - Section 8.8
- Requirements for Surveillance and Audits - Section 6.5

This SAP is also meant to provide specific objectives and details for OU 2 activities not provided in the SCQ and QAPjP, or provide documentation of exceptions or additions to those documents. Sections of the SCQ and/or QAPjP which are not changed may be incorporated by reference.

1.2 SCOPE

The OU 2 Work Plan Addendum for RI/FS details project specific tasks to be completed. To meet the data requirements of the work plan, sampling and analyses will be performed for each unit of OU 2. The five subunits, or waste areas, that comprise OU 2 are:

- Solid Waste Landfill
- Lime Sludge Ponds
- Inactive Flyash Pile
- South Field
- Active Flyash Pile

Sections 2.0 and 3.0 of this SAP establish project specific sampling objectives and activities and DQOs. Sections 4.0 through 6.0 contain the Project Organization, Health and Safety, and Quality Assurance and Quality Control guidance. Sections 8.0 and 9.0 provide the requirements for general field procedures, sample collection, laboratory analyses, quality assurance and control, data management, and project schedule.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

There have been three investigations of the OU 2 waste units: the Environmental Survey (ES), the Characterization Investigation Study (CIS); and the Remedial Investigation/Feasibility Study (RI/FS) sampling program. These studies have characterized areas of the surface and subsurface soils/waste, surface water, sediment, and groundwater for each of the five OU 2 subunits.

The ES was conducted by DOE in 1985 and 1986. The purpose of this survey was to identify existing environmental concerns and areas of environmental risk. The ES sampling and analysis program was limited in scope and intended only to confirm the presence of contamination in selected locations. It was not intended to characterize the full nature and extent of contamination or rate of contaminant movement.

The CIS was performed Roy F. Weston, Inc. in 1986 and 1987. A geophysical survey was conducted to provide information on waste volumes, shallow stratigraphy, and the presence of buried steel drums and tanks. Borings were drilled and trenches were excavated to determine the vertical distribution of chemical and radiological constituents. A surface radiological survey was also completed for surface media and stream sediments.

The RI/FS sampling for OU 2 was conducted in phases from 1987 to 1992 by DOE. Surface media, subsurface media, surface water, sediments, and groundwater were sampled and analyzed for radiological and chemical parameters. Trenches were also excavated in the Solid Waste Landfill and South Field to visually characterize the waste material. These samples were intended to characterize the nature and extent of contamination in the OU 2 subunits.

2.1 SOLID WASTE LANDFILL CHARACTERIZATION

The operational history of the Solid Waste Landfill (SWL) is not well understood, and available data suggest that the waste types are heterogeneous. Aerial photographs and trenching have not yet confirmed the presence or absence of disposal cells that were reportedly oriented east-west. Previous investigations reveal the following:

- Few subsurface samples have been collected for organic analyses. Waste materials observed in one of three trenches excavated in July 1992 included unidentified sealed cans associated with elevated Hnu readings.

- During the July 1992 trenching in the SWL, elevated radioactivity levels were detected with field instruments when an unidentified yellow material was encountered in Trench Number 3;

- An historical aerial photograph (1954) identified an apparent dumping face where RI sampling in 1988 detected uranium concentrations ranging from 150 to 940 mg/kg;

- Surface samples from the SWL were not analyzed for organic compounds; values of total uranium ranged from 368 to 1,180 mg/kg;

- A groundwater sample from Well 1719 collected June 9, 1992, detected 2,390 µg/l total uranium. In comparison, concentrations of total uranium detected in leachate samples collected from the three trenches ranged from 375 to 1,610 µg/l. However, groundwater samples collected from three 1000-Series wells completed in the till surrounding the SWL detected a maximum of 11 µg/l total uranium. The fact that elevated uranium concentrations were not detected in surrounding wells suggests that there is poor horizontal flow in the till; and

2.2 LIME SLUDGE PONDS CHARACTERIZATION

The operational history of the Lime Sludge Ponds (LSPs) is well documented, since the waste material originated as a water treatment process waste product. Previous investigations of the ponds, and of the soil and groundwater surrounding the ponds, suggest the following:

- Disposal of waste material was confined to the ponds;

- The South Pond was filled first, followed by the North Pond. The ponds are relatively homogeneous in material and chemical content;

- Berm materials are of unknown origin;

- Shallow soil uranium and radium contamination is highest adjacent to the north boundary (roadway) and the south boundary (adjacent to the K-65 Trench). CIS analytical results for surface sampling along the K-65 trench indicated that contamination was less than 1 foot deep;

- Uranium and thorium isotopes were detected in surface soil samples, and uranium, thorium and radium isotopes were detected in six CIS composite and four RI samples. Strontium was detected in one RI subsurface sample collected from the subsurface soil adjacent to the K-65 Trench. These same isotopes are found in K-65 Trench waste materials;

- Regional groundwater flow is from west toward the east, and shallow groundwater is believed to flow radially from the ponds. There are no monitoring wells on the west (upgradient side for the regional aquifer) and only one well on the south side of the ponds; and

- Uranium concentrations in groundwater are highest in Well 1042, adjacent to the K-65 Trench.

2.3 ACTIVE FLYASH PILE CHARACTERIZATION

The operational history of the Active Flyash Pile (AFP) is well understood. Waste material in the pile is believed to be homogenous since it was generated from the burning of coal at the boiler plant. Previous investigations show the following:

- Uranium concentrations are relatively constant in samples collected from the surface and from depth in the AFP, and are similar to those expected for flyash materials;

- No sampling has been undertaken to characterize native material beneath the pile; and

- Groundwater in 1000-Series and 2000-Series wells north and south of the pile have not detected significant uranium contamination. There are presently no 2000-Series wells upgradient (west) or downgradient (east) of the Flyash Pile.

2.4 INACTIVE FLYASH PILE CHARACTERIZATION

Flyash from the FEMP coal-fired boiler plant was apparently dumped over the natural slope along the east side of Paddys Run to form the Inactive Flyash Pile (IFP) from 1952 to 1968. The operational history of this unit is not completely understood and building material has been observed on the surface of the Flyash Pile and occasionally in surface samples. The IFP has a soil cover of unknown origin and has mature trees covering most of the unit. The following information has been obtained from previous investigations of the site:

- Surface soil sampling has detected elevated concentrations of uranium (Borings 1710 and 1791).

- Subsurface soil sampling has detected elevated concentrations of uranium in soil below the flyash. The impacted area appears to correlate with fill disposal areas seen in 1954 and 1957 aerial photographs and are believed to be relatively shallow in extent.

- The "background" concentration of radioisotopes observed in uncontaminated flyash material is typical of Northern Kentucky coal and is not believed to be the source of uranium in the underlying soils.

- Well 1711, completed in the glacial till beneath the Inactive Flyash Pile, detected 550 μg/l total uranium in one groundwater sample collected on June 16, 1992. This well is in the vicinity of Wells 1047 (north) and 1433 (southeast) and indicates the perched water zone may be continuous in this area.

2.5 SOUTH FIELD CHARACTERIZATION

The timing, sequence, and source of materials and wastes disposed in the South Field (SF) are poorly documented. The northwestern perimeter of the subunit is contiguous with the Inactive Flyash Pile subunit, and the Active Flyash Pile subunit lies adjacent to the southeastern perimeter. The estimated boundary of the subunit includes approximately 13 acres which are mostly level and grass covered. The southern perimeter of the site slopes steeply to the terrace of the local drainage.

Previous investigations and interpretation of the data reveal the following about fill, soil, and groundwater at the subunit:

- Fill containing heterogenous waste materials (e.g.construction rubble, demolition debris, burned coal, coke, flyash) covers the site and is typically less than 10 feet thick;
- The southern portion of the site contains fill up to 33 feet thick (as reported in RI boring 1792);
- One surface geophysical (terrain conductivity) and two surface-screening radiological surveys were conducted across the site. Areas of elevated surface radioactivity were verified by surface and subsurface sample analyses and appear to correlate with the surface survey data and disturbances noted in historical (1954, 1957) aerial photographs;
- Surface soil sample, boring, and trench locations where selected based on the survey results which indicated areas of elevated activity and/or buried objects. As a result, subsurface sample locations (borings and trenches) were primarily across the northern portion of the subunit, and secondarily along the eastern edge of the subunit;
- Surface soil sample locations were concentrated across the northern portions of the subunit and adjacent to the Inactive Flyash Pile subunit;
- Characterization data show that uranium, thorium, and radium are present across the site; the highest concentrations were found in surface soils across the northern portion of the site (area of highest sample density). The highest concentration of uranium, thorium, and radium in subsurface soils correlate well with surface elevated activity, but the concentrations are generally one order of magnitude lower in subsurface soils;
- Although waste-related organic and inorganic constituents are numerous, they typically exhibit low frequency of detection and low concentrations.

- Only four 1000- and 2000-Series monitoring wells are within the boundaries of the subunit, and all four are located near the northwestern perimeter;

- Groundwater in till and the upper Great Miami Aquifer directly beneath the subunit has not been characterized; groundwater flow is generally east to west in the Great Miami Aquifer;

- Total uranium ranged from 3,600 to 4,000 μg/l in four samples collected in November 1992 from Well 1433. This suggests that there is a uranium source which has impacted groundwater in the northwest portion of the subunit or in the Inactive Flyash Pile; and

- Surface water runoff and sediment samples along the east, west and southern perimeter of the subunit have not been characterized.

2.6 CONCEPTUAL SITE MODEL

A conceptual site model was developed for FEMP in the 1988 RI/FS Work Plan (DOE 1988b). Although the FEMP model included elements of OU 2, a conceptual site model focused upon OU 2 is included in this SAP as Figure 2-1. A unit specific model is useful to guide the following critical steps in the RI/FS process:

- Development of data needs and sampling rational;

- Investigation of significant migration pathways;

- Selection of fate and transport models;

- Assessment of risks associated with OU 2 subunits; and

- Evaluation of preliminary remedial alternatives.

Elements of the physical system are shown in Figure 2-1. These elements include the following:

- Contaminant sources

  - wastes buried in the Solid Waste Landfill
  - flyash and wastes, rubble, and debris buried in the Inactive Flyash Pile
  - contaminated soils, rubble, and debris in the South Field
  - sludges in the Lime Sludge Ponds
  - flyash in the Active Flyash Pile

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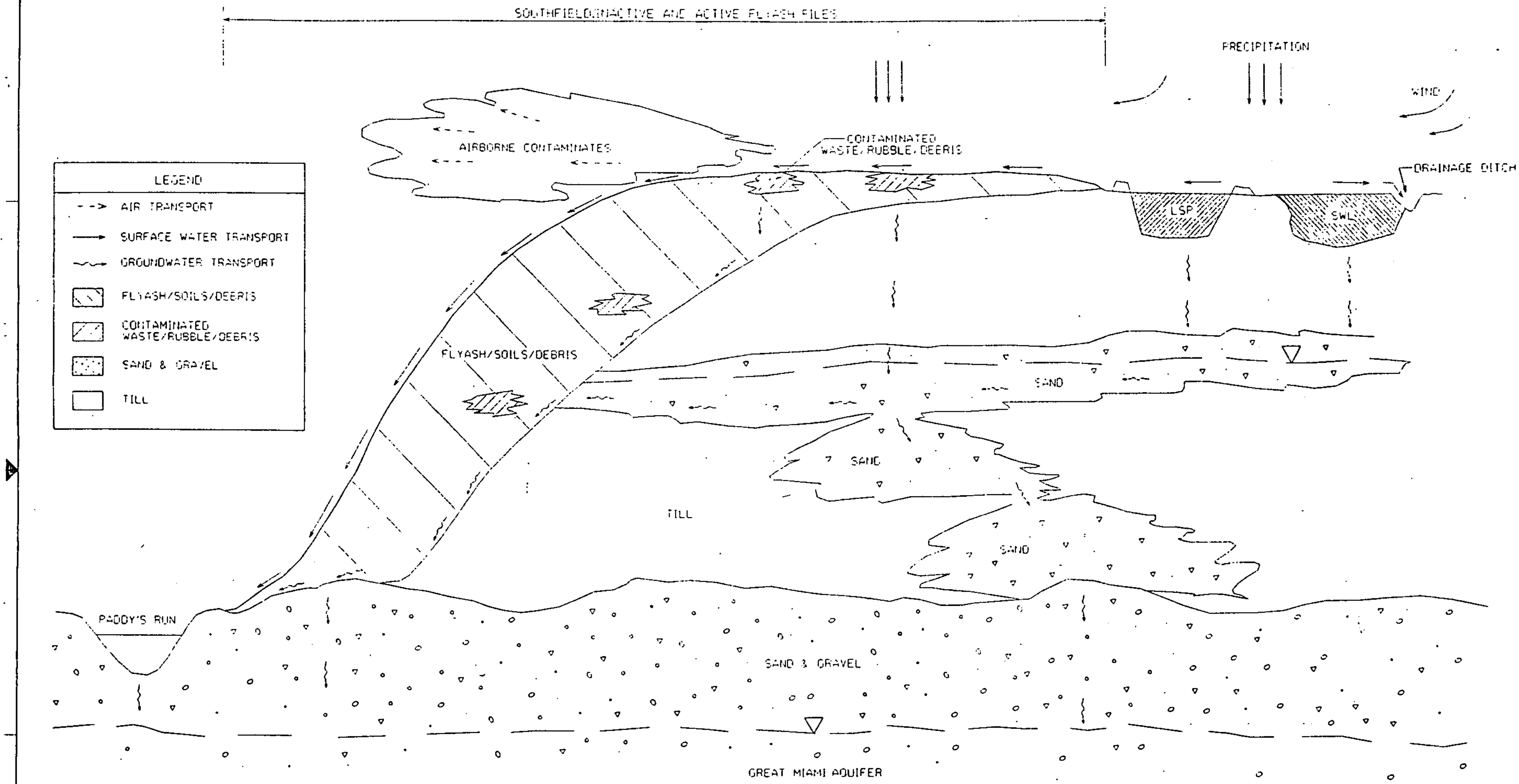

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FIGURE 2-1

GENERALIZED CONCEPTUAL MODEL FOR OU 2

- Transport Mechanisms
  - wind erosion
  - precipitation leading to surface runoff
  - infiltration and percolation of precipitation
  - groundwater flow
- Contaminant Pathways
  - surface soil erosion via wind and transport in air
  - surface soil erosion via precipitation and transport as sheet flow and surface water in drainages and streams
  - infiltration of precipitation and percolation through contaminated soils, wastes, rubble, debris, and flyash and migration via perched groundwater
  - discharge of contaminated perched groundwater via seeps, springs to surface water
  - recharge of contaminated perched groundwater and/or surface water to the Upper Great Miami Aquifer
  - downstream flow of contaminated surface water via Paddys Run

The conceptual model summarizes transport paths that contaminants may take to reach potential receptors. Although many exposure pathways are possible, the conceptual site model focuses on those believed most likely to contribute significantly to overall risks to human health and the environment. More extensive discussion of exposure pathways are presented in the Risk Assessment Work Plan Addendum, (DOE, 1992a).

3.0 OBJECTIVES OF THE REMEDIAL INVESTIGATION

3.1 SAMPLING OBJECTIVES

3.1.1 Solid Waste Landfill

The Remedial Investigation for the Solid Waste Landfill subunit is designed to address the following objectives:

- To characterize the surface soils across the SWL;
- To characterize sediment and surface water;
- To define the impacts of a suspected evaporation pond in the northwest corner of the SWL;
- To complete the organic chemical and radiological characterization of the waste material and the clay beneath the waste, and confirm the presence or absence of disposal cells;
- Define impacts to the perched aquifer zone; and
- Determine groundwater flow direction and possible contaminant migration in the upper Great Miami Aquifer.

A summary of the objectives and proposed sampling activities is provided in Table 3-1.

A soil gas survey is proposed to locate sources of organic contamination in the shallow disturbed subsurface. Probes will be driven two to five feet deep and gas samples will be collected directly by an organic vapor analyzer and analyzed by flame ionization detector. Additional gas samples will be collected in a more dense pattern around areas where contaminants are known or suspected based on previous sampling, and the observations of waste types encountered during the 1992 trenching activity. The results of the soil gas survey will be used to optimize the selection of locations of subsurface borings and surface soil sample collection.

Twelve surface soil samples will be collected from the surface to six inches deep to complete the characterization of the SWL soils. The surface samples will be analyzed for the Full Hazardous Substance List (HSL) and Full radioisotopes.

Table 3-1
Solid Waste Landfill Sampling Objectives and Activities

Sampling Objectives	Sampling Activities
Determine the extent of surface soils contamination.	Collect 12 surface soil samples.
Determine the sediment and surface water contamination in the drainage areas.	Collect 2 sediment and 2 surface water samples upstream and downstream of the SWL.
Determine the location of waste deposit areas or possible waste cells.	Collect and analyze in the field approximately 33 soil gas samples on a 50 x 40 foot grid.
Characterize contamination due to the suspected evaporation pond in the northwest corner of the Solid Waste Landfill.	Drill 2 to 4 borings on the west side of SWL and · Collect samples of waste materials · Collect samples at the waste/native soil interface · Collect samples below the waste/native soil interface
Determine the extent of waste material present in the waste cells and the dump face shown in aerial photos, and determine the depth of soil contamination.	Drill 10 to 15 borings throughout the SWL, and · Collect 1 waste sample based on field screening · Collect 1 soil sample 5 feet below the waste/native soil interface
Determine impacts to the perched groundwater zone.	Install three 1000-series wells · One at the west side of the subunit · One at the south side of the subunit · One at the east side of the subunit Collect and analyze groundwater samples from 3 new and 4 existing 1000-series wells (1035, 1037, 1038, and 1719).
Determine impacts to groundwater quality in the upper part of the regional aquifer.	Install three or four 2000-series wells · One at the west side of subunit · One at the north side of subunit · One at the east side of subunit · One at the south side of subunit if analysis indicates groundwater flow to the south Collect and analyze groundwater samples from 3 or 4 new and 3 existing 2000-series well (2027, 2037, and 2052).

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Sediment and surface water will be collected in the drainage course along the northern boundary of the SWL at both up-stream and downstream locations (total of two sediment and two water samples). These samples will be analyzed for the Full HSL and Full radioisotopes. Additional sediment samples will be collected from four locations, equidistant from the upstream and downstream locations, and analyzed on-site for total uranium on two screened fractions (total of eight samples). This will allow elevation of the relationship between particle size and uranium concentration that might exist in reworked sediments.

Two borings are proposed to determine the impact from a reported evaporation pond in the northwest corner of the SWL. Locations will be selected from scaled aerial photographs. The borings will be approximately eight feet deep. Samples will be collected from the recovered soil cores for laboratory analyses based upon field screening data, and on-site lab screening analyses. The intent is to determine if waste materials are present. If no waste materials are encountered after two borings, then up to two more borings will be drilled (for a total of up to four). If no waste materials are encountered after four borings, then the objective will be considered met. Three samples will be collected from each boring: the sample with the highest organic vapor reading or radioactivity, a sample from the waste-native soil interface, and a sample from two to five feet below the waste and native soil interface (total of six to twelve samples). Soil/waste samples will be analyzed for the Full HSL and Full radioisotopes.

Ten soil borings are proposed to collect waste samples and characterize the range of materials contained within the disposal cells or open dump at the SWL. Depths of the borings are expected to range from 6 feet to 20 feet depending upon the depth of waste material. Up to five additional borings will be considered if the planned borings do not encounter waste materials. Waste materials encountered during the boring may consist of solid material or a combination of solid waste material and leachate. Samples will be selected based upon the highest reading of field screening for volatile organic vapor, radioactivity, pH, or because of visual evidence. Initially, waste material will be collected from a bucket auger from each boring for chemical and radiological characterization (total of 10 samples). Subsequently, ten samples will be collected using hollow stem augers and split spoons from five feet beneath the material in the till to allow evaluation of the vertical attenuation of contaminants in the till (total of 10 samples). Samples will be analyzed for the Full HSL and Full Radioisotopes. One boring will be drilled into the location of trench number three to collect samples of the material that was observed, but not sampled, during the July 1992 trenching activity.

Two 1000-Series wells are proposed to complete the investigation of perched groundwater at the SWL.

Three 2000-Series wells are proposed to characterize upgradient and downgradient groundwater quality in the upper Great Miami Aquifer. These are located west, north and east of the SWL. After the newly installed wells are surveyed, an analysis will be performed to determine the direction of groundwater flow. If water levels in the wells indicate that flow is toward the south, a fourth 2000-Series well will be completed south of the SWL. The exact location for the fourth well will be based upon the measured gradient in the three new wells. All existing wells (total of eight) and new wells (total of five or six) will be sampled for Full HSL and Full radioisotopes (total of 13 or 14 wells).

3.1.2 Lime Sludge Ponds

Additional samples are required for the Lime Sludge Ponds subunit to:

- complete the characterization of organic and radiological contamination of the sludge;
- define potential contaminant impacts of the ponds upon the underlying soil;
- characterize potential contamination in berm materials;
- define the surface contamination of the waste unit;
- complete characterization of the groundwater system at the site; and
- define impacts of possible leakage from the K-65 Trench on soil and groundwater.

A summary of the objectives and proposed sampling activities is provided in Table 3-2.

Four borings will be drilled in the North Pond and four borings will be drilled in the South Pond to complete the characterization of the sludge, to confirm the depths of the ponds, and define potential contaminant impacts of the ponds upon the underlying soil. The thickness of the lime sludge is thought to be between 8 feet and 10 feet below grade. Two borings in each pond will have samples taken at a depth of 2 feet and 2 feet beneath the bottom of the pond. Two borings in each pond will have the samples taken at a depth of 5 feet and 2 feet beneath the bottom of the pond. One boring in each pond will have a sample taken 5 feet below the bottom of the pond (total of 18 samples). Samples will be analyzed for Full HSL and Full Radioisotopes.

Table 3-2
Lime Sludge Ponds Sampling Objectives and Activities

Sampling Objectives	Sampling Activity
Determine the extent of surface and shallow subsurface contamination.	Collect surface soil/waste samples from each pond interior at 2 locations. Collect surface and shallow soil samples at 6 locations outside ponds. Collect surface water sample from North Pond.
Determine the extent of surface contamination along roadways.	Collect surface soil samples from roadway north of ponds at 2 locations.
Determine the extent of contaminants in berm material.	Collect 7 shallow subsurface soil samples from berms.
Characterize sludge and underlying soil and determine sludge depth for remedial alternative evaluation.	Drill 4 borings in each pond and · Collect waste sample at 2 ft depth and soil sample at 2 ft beneath pond bottom at 2 locations in each pond; · Collect waste sample at 5 ft depth and soil sample at 2 ft beneath pond bottom at 2 locations in each pond; · Also collect soil sample at 5 ft below pond bottom at 1 location in each pond.
Determine impacts to groundwater quality in the upper part of the regional aquifer.	Install three 2000-series wells · one at west side of subunit · two at east side of subunit. Collect and analyze groundwater samples from 3 new and 1 existing 2000-series wells (2042).

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Table 3-2
Lime Sludge Ponds Sampling Objectives and Activities

Sampling Objectives	Sampling Activity
Determine impacts on the perched groundwater zone.	Install three 1000-series wells · two at west side of subunit · one at south side of subunit Collect and analyze groundwater samples from 3 new and 7 existing 1000-series wells (1039, 1041, 1042, 1134, 1176, 1210, 1229).
Determine the impacts of the K-65 Trench on shallow groundwater, especially Well 1042 and Well 2042.	Trench along side of the K-65 Slurry Line Trench and collect up to 4 soil samples to characterize source of activity. Collect 2 samples of residue in the K-65 Trench adjacent to the Lime Sludge Ponds.

Berm materials are of unknown origin, and a shallow sample from 6 to 12 inches deep will be collected from the center of the three outer berms of each pond to characterize potential contamination. One sample will be collected from the center of the berm common to both ponds (total of seven samples). Samples will be analyzed for Full HSL and Full Radioisotopes.

To define the surface and shallow subsurface contamination around the perimeter of the ponds samples will be collected from the surface and from 2 foot depths at six locations outside of the ponds (total of 12 samples). These samples will be analyzed for Full HSL analytes and Full Radioisotopes.

The North and South Ponds will each have two samples collected from the surface (total of four samples). One surface water sample will be collected from the North Pond. These samples will be analyzed for the Full HSL and Full Radioisotopes. In addition two surface soil samples will be collected from two locations on or near the roadway on the north side of the ponds. These samples will also be analyzed for Full HSL and Full Radioisotopes.

A characterization of the groundwater system at the subunit will be provided by completing the array of 1000- and 2000-Series monitoring wells around the ponds. The flow direction of perched groundwater is not determined at this time. Two 1000-Series wells are proposed for the west side of the ponds, and one is proposed for the south side of the ponds. To determine the impact of the subunit on the upper Great Miami Aquifer, three 2000-Series wells are proposed, including two wells placed on the downgradient side (east side) and one well placed on the upgradient side (west side) of the ponds. The new wells and the existing wells will be sampled for the Full HSL and Full Radioisotopes. Soil samples will be collected from the screened interval during well installation, and will be analyzed only for the Full Radioisotopes.

To identify subsurface impacts of potential leakage from the K-65 Trench, particularly near Well 1042, a trench is proposed to be excavated adjacent to it. The trench will be approximately 5 feet deep, and excavated soil will be field screened. Screening samples that contain elevated radioactivity will determine where additional samples will be collected for laboratory analyses. An estimated four soil samples will be collected and analyzed for the Full HSL and Full Radioisotopes. Two samples will also be taken of residue in the K-65 Trench and analyzed for the Full HSL and Full Radioisotopes.

3.1.3 Active Flyash Pile

Additional work will be required in the Active Flyash Pile subunit:

- to characterize potential organic contamination of the flyash;
- to characterize the material beneath the pile;

- to define potential surface migration of contaminants; and
- to define potential downgradient groundwater impacts.

A summary of the objectives and proposed sampling activities is provided in Table 3-3.

Three borings are proposed to complete the subsurface investigation. The borings will be drilled 5 feet into native material beneath the flyash, which is expected to be 35 to 40 feet deep. All samples will be screened in the field for total organic vapors and radioactivity. Five samples will be collected from each boring at the following depths:

- one sample from the surface;
- one sample from 2 feet deep;
- one sample from the middle of the boring;
- one sample from the interface of flyash and native material; and
- one sample from 5 feet beneath the Flyash Pile.

Each sample (total of 15 samples) will be sent to the laboratory for analyses for the Full HSL and Full Radioisotopes.

Six surface samples are proposed for the Active Flyash Pile. Locations will be selected to be approximately equidistant from the three proposed borings and the base of the pile. All samples (total of six) will be analyzed at the contract laboratory for the Full HSL and Full Radioisotopes.

Six sediment and two surface water samples are proposed to define potential surface migration of contaminants from the Active Flyash Pile. Sediment will be collected in two locations to coincide with surface water sampling locations. Four additional locations will be selected to collect sediment samples between the pile and the storm water drainage. All samples (total of eight samples) will be sent to the laboratory for analysis of the Full HSL and Full Radioisotopes.

One 2000-Series well will be completed downgradient (east) of the Active Flyash Pile. The actual location will depend on field access and will be based upon the best average location after review of historical groundwater gradients. Samples will be collected from the new well and existing wells for total uranium analysis at the on-site laboratory using rapid turn-around time to determine if the extent of contaminated groundwater is defined. Samples will also be submitted to the laboratory for analysis of the Full HSL and Full Radioisotopes.

Table 3-3
Active Flyash Pile Sampling Objectives and Activities

Sampling Objectives	Sampling Activities
Determine the extent of surface soils contamination.	Collect 6 surface soil samples.
Determine potential surface migration of contaminants.	Collect 2 surface water samples from 2 locations and 6 sediment samples from 6 radial locations around the flyash pile.
Characterize contamination within and below the Active Flyash Pile and characterize the potential organic contamination of the flyash.	Drill 3 soil borings and · Collect a sample at the surface · Collect 2 samples within the flyash · Collect a sample at the interface between flyash and native soil · Collect a sample 5 ft. beneath the fill.
Determine impacts to the perched groundwater zone.	Collect and analyze groundwater samples from 2 existing wells (1045 and 1048)
Determine impacts to the downgradient groundwater quality in the upper part of the regional aquifer.	Install a 2000-series well east of the Flyash Pile Collect and analyze groundwater samples from 1 new and 3 existing wells (2045, 2048, and 2049).

A 1000-Series well is not proposed because it is not believed that saturated till exists to the east of the Active Flyash Pile. A 1000-Series well may be completed contingent upon conditions observed during the drilling of the proposed 2000-Series well.

3.1.4 Inactive Flyash Pile

Additional field investigation and analysis are required to define the nature and extent of organic, inorganic and radiological contamination of the soil cover, the flyash material, the underlying soil/fill, the groundwater, and surface water. A summary of the objectives and proposed sampling activities is provided in Table 3-4.

Five borings are proposed to characterize subsurface materials. Four samples will be taken from each boring for Full HSL and Radioisotope analysis as follows:

- one sample in the soil cover
- one sample of flyash selected on the basis of the highest field screen activity level.
- one sample of underlying soil or fill below the ash
- one sample of in-situ soil 5 feet below the ash-fill zone.

Based on field observations, additional samples will be taken of fill if its thickness exceeds 3 feet (one for each 3 foot interval). In this case, the fill sample with the highest field activity level will be selected for analysis.

In addition, four samples of flyash from each boring will be sent to the on-site laboratory for analysis by gamma spectrometry. Sample selection will be as follows:

- Upper third of flyash column
- Mid third of flyash column
- Lower third of flyash column
- Highest field screen activity level (Note: Same sample interval described above).

In addition 5 samples of flyash will be analyzed in accordance with provisions of OAC 3745-30 for leach of metals. Note: These samples will be split from the highest field screen activity level samples addressed above.

Table 3-4
Inactive Flyash Pile Sampling Objectives and Activities

Sampling Objectives	Sampling Activities
Determine the extent of surface soils contamination.	Collect and analyze 7 surface samples from the upper-most 6 in. of the soil cover.
Determine the potential surface migration of contaminants.	Collect sediment and surface water samples from upstream and downstream locations in Paddys Run and from two local drainage features.
Characterize contamination within and below the Inactive Flyash Pile.	Drill 5 borings and collect waste and soil samples as follows: · Collect soil cover sample at 6-12 in. depth. · Collect ash samples at highest rad. field screen. · Collect sample of underlying fill or soil just below ash. · Collect additional samples of fill if greater than 3 ft. thick. · Collect sample 5 ft. below fill/native soil interface.
Determine impacts to the perched groundwater zone.	Install one 1000-series well (based on results of South Field Hydropunch investigation). Collect and analyze groundwater samples from 1 new and 2 existing wells (1047 and 1711).
Determine impacts to the groundwater quality in the upper part of the regional aquifer.	Install one 2000-series well adjacent to Well 1711. Collect and analyze groundwater samples from 1 new and 4 existing wells (1016, 2016, 2047, and 2402).

Based on field observations, as many as three contingency borings may be required to further define areas of elevated activity. These borings would be utilized if a zone exhibited a field activity in excess of 100 Pci/g. Sampling would be focused on the impacted zone with samples analyzed for the Full HSL and Full radioisotopes.

Seven surface samples will be taken from the soil cover and analyzed for the Full HSL and Full radioisotopes. Sediment and surface water samples will be collected from upstream and downstream locations in Paddys Run and from two drainage features flowing from the unit. All sediment and water samples will be analyzed for the Full HSL and Full radioisotopes.

Groundwater samples will be taken in conjunction with the South Field investigation using a Hydropunch ™ to establish the probable source of uranium contamination at Wells 1711 and 1433. Subsequently, one 1000-Series well will be installed in the glacial till. The exact location of this well will be governed by the Hydropunch investigation with the goal of locating the well in near proximity to any observed source. One 2000-Series well will be installed adjacent to Well 1711 to monitor the upper Great Miami Aquifer.

3.1.5 South Field

Additional surveying, sampling and monitoring well installations are required at the South Field to provide the following:

- Locate concentrated areas of buried rubble and debris which may be the source of radiological contamination in the shallow subsurface;
- Excavate, observe, screen, and sample potential areas of elevated activity associated with buried rubble and debris in the shallow (max. depth 10 feet) subsurface;
- Define the lateral extent of contamination in surface soils across the site;
- Define the vertical extent of subsurface contamination at previously or newly defined areas of elevated activity
- Further investigate the nature and extent of subsurface contamination in the central and southern portions of the site where existing data points are sparse;
- Complete characterization of the perched groundwater (in till) system and define impacts on underlying Great Miami Aquifer.

A summary of the objectives and proposed sampling activities is provided in Table 3-5.

The locations of potentially contaminated buried rubble and debris will be assessed with a combination of surface geophysics and trenching. Electromagnetic terrain conductivity and magnetometry measurements will be conducted on an initial 50 by 50 feet grid. Anomalous areas, as interpreted by the geophysicist, will be revisited in real time and additional measurements will be taken at 25-foot intervals to further define their lateral extent. Subsequently, up to 10 of the most significant anomalies will be investigated by excavation, observation, and screening for total organic vapors and radioactivity. The following actions will be based on the screening results:

- Wipe samples of large rubble or debris (greater than 2 feet in one dimension) will be collected for Full HSL and Full Radioisotope analyses (estimate 5 samples);
- Samples from areas exhibiting the highest readings in each excavation will be collected for on-site radionuclide screening and Full HSL and Full Radioisotope analyses (estimate 10 samples), and
- Excavations exhibiting the highest readings will be targeted for surface and subsurface soil sample collection and analyses (see below).

Surface samples will be collected at 21 locations throughout the South Field to define areas of elevated activity and the lateral extent of surface contamination. Near surface soil samples (6 to 12 inches depth) will be collected from 10 of the surface soil sample locations. These samples will be analyzed to determine applicability of 40 CFR 192. All samples will be analyzed for Full HSL and Full Radioisotope analyses.

Up to twenty borings are proposed to determine the vertical extent of contaminant migration in areas of elevated activity and geophysical anomaly areas, and to complete physical and chemical characterization of the fill and underlying till in areas which were not investigated by previous work (central and south portions of subunit).

Borings will terminate at a depth below the fill when the radiological field screening indicates levels approximately equal to background levels, estimated to be 15 feet below the surface in most areas of the subunit. However, due to the thickness of fill in the southern portion of the subunit, 5 borings are estimated to reach a depth of 40 feet. All samples from the borings will be archived and one sample of the fill from each boring will be selected for laboratory analyses based upon the field measured radioactivity and on-site laboratory screening analyses

Table 3-5
South Field Sampling Objectives and Activities

Sampling Objectives	Sampling Activities
Determine locations of potentially contaminated buried rubble and debris.	Conduct a terrain electroconductivity survey using 50 x 50 ft. grid; investigate anomalies with radiation survey
Determine if rubble/debris are a source of contaminants, characterize subsurface soil contamination associated with rubble/debris.	Excavate trenches at locations of 10 most significant geophysical anomalies: · 5 wipe samples of rubble/debris · 10 soil samples
Characterize contamination of fill materials within and below the South Field.	Drill 20 borings: · 15 borings at elevated activity area in north and central South Field · 5 borings in southern area
Determine the extent of surface soil contamination.	Collect 21 soil samples (0-6 in. depth) at selected areas; 6-12 in. depth at 10 of 21 locations
Determine impacts on the perched groundwater zone.	Install two 1000-series wells · 1 in northern South Field · 1 in central South Field Sample 2 new and 6 existing wells (1046, 1065, 1433, 1516, 1517, and 1518)

Table 3-5
South Field Sampling Objectives and Activities

Sampling Objectives	Sampling Activities
Determine the impacts on the groundwater quality in the upper part of the regional aquifer.	Install three 2000-series wells · 1 adjacent to Well 1433 · 1 in central South Field · 1 in southern South Field Sample 3 new and 6 existing wells (1014, 2014, 2046, 2065, 2385, and 2401)
Investigate the source and/or lateral extent of shallow groundwater contamination near Wells 1433/1711.	Conduct Hydropunch sampling in a radial pattern around Wells 1433 and 1711 to locate and sample perched groundwater for on-site screening Collect subsurface soil samples from Hydropunch borings (analyze as boring samples above)
Determine the potential surface migration of contaminants	Collect surface water and sediment samples from 4 locations: · 3 along southeast perimeter · 1 adjacent to Inactive Flyash Pile

by gamma spectrometry. A second sample will be selected from the same boring to define the radioisotope level in native material beneath the fill. An estimated 40 samples will be submitted for Full HSL and radioisotope analyses. Additional borings or deeper borings may be required to define the lateral and vertical extent of contamination based on the screening results.

Two 1000-Series wells are proposed to investigate perched groundwater in the till beneath the central part of the South Field. Three 2000-Series wells are proposed to characterize potential impacts on the upper Great Miami Aquifer. All wells will be sampled and a water sample analyzed on-site using rapid turn-around time to determine total uranium. The decision to install additional wells will be made based on the screening results. All wells will be sampled and samples will be analyzed for Full HSL and radioisotope analyses.

A combination soil boring and Hydropunch ™ groundwater sampling is proposed to trace the origin and/or lateral extent of the groundwater contamination found in Wells 1433. Initially, 10 locations will be selected based on field observations and existing survey data. The Hydropunch ™ will permit collection of water samples in the till during completion of the borings. Hydropunch ™ water samples will be collected from 2 to 5 feet below the first evidence of soil saturation observed in the continuous split spoon soil samples. Following the collection of a groundwater sample, the borings will terminate at a depth below the fill when the radiological field screening indicates levels approximately equal to background levels, estimated to be 20 feet below the surface. The borings will be sampled continuously and all samples will be field screened and archived. Based on the field screening, one sample of the fill (highest reading), one sample from the bottom of each borehole, and all groundwater samples, will be screened at the on-site laboratory using gamma spectrometry. An estimated 10 water and 20 soil samples will be screened. An estimated 10 soil samples from the borings will be submitted for Full HSL and radioisotope analyses.

Sediment and surface water samples will be collected from drainages leading away from the South Field. Four locations have been identified and a sediment and water sample will be collected from each location. All samples will be analyzed for Full HSL and radioisotopes.

3.2 DATA QUALITY OBJECTIVES

3.2.1 Intended Use of Data

The data objectives and sampling activities have been described in Section 3.1. The resulting data are intended to satisfy the following RI/FS objectives:

- Complete characterization of the nature and extent of contamination in wastes, soil, sediments, surface water, and groundwater for

    - fate and transport modeling / risk assessment
    - source control remedial alternative development

- Establish/quantify waste subunit impacts on perched groundwater and the upper Great Miami Aquifer

3.2.2 Development of DQOs

One of five FEMP-defined analytical support levels (ASLs) will be assigned to all data to be collected depending on the intended use of the data. The specific definitions of the five ASL levels (A through E) are provided in the FEMP SCQ and are summarized in Table 3-6.

The types of data to be collected and the field and analytical methods to be utilized for the RI have not changed significantly from previous RI/FS activities completed at the FEMP. For that reason, the following existing FEMP DQOs are referenced for use:

- SD-002 Sediment Sampling, RI/FS
- SL-002 Soil Sampling, RI/FS
- SW-002 Surface Water Sampling, RI/FS
- GW-002 Groundwater Sampling, RI/FS

Copies of the summary forms for these existing DQOs are included in Appendix A. The following exceptions to the referenced DQOs will be incorporated:

- All FEMP HSL laboratory analyses and data validation for soil, waste, sediment, surface water, and groundwater samples will be performed at ASL C, with 10% at ASL D for each matrix;

- All FEMP radiological laboratory analyses and data validation for soil, waste, sediment, surface water, and groundwater samples will be performed at ASL E, or at a minimum will meet the requirements of ASL C in support of risk assessment;

- TCLP, laboratory screening for radioisotopes and/or HSL parameters, and general water chemistry analyses and data validation will be performed at ASL B;

- Field screening, soil gas survey, geophysical surveys, and geotechnical analyses will be performed at ASL A; and

- Container blanks will not be prepared or analyzed.

4.0 ORGANIZATION AND RESPONSIBILITIES

4.1 ORGANIZATION

This section describes the organizational and management structure to be used in implementing the approved OU 2 RI/FS Work Plan Addendum at the FEMP. An Environmental Restoration Management Contract (ERMC) approach has been implemented at the FEMP site to manage the restoration activities, with Fernald Environmental Restoration Management Corporation (FERMCO), a wholly owned subsidiary of Fluor Daniel Inc,, currently serving as the ERMC. The ERMC, reporting directly to the Department of Energy Fernald Field Office (DOE-FN), will act as the main contractor for FEMP activities and coordinator of technical support and remediation subcontractors. Under the current FERMCO organizational structure, OU 2 activities will be the responsibility of CERCLA/RCRA Unit 2 (CRU2), with such activities being conducted by individuals of various disciplines matrixed to OU 2 from other FERMCO departments. Implementation of the OU 2 Work Plan Addendum will be the specific responsibility of the Environmental section within OU 2.

4.2 RESPONSIBILITIES

The major tasks that constitute the OU 2 RI/FS program implementation and the organizational responsibilities to carry out those tasks are identified here. Primary responsibilities for implementing the OU 2 Work Plan Addendum will rest with the Environmental section matrixed to OU 2 of the FERMCO organization, with additional necessary support provided through matrixing from other FERMCO departments and through subcontracts as appropriate to ensure quality and timeliness. Task specific responsibilities will be implemented as follows:

1. Complete overall planning, integration, execution, and support of the OU 2 RI/FS program. Implementation of these activities, is the responsibility of the Environmental section matrixed to OU 2.

2. Prepare and obtain approval of OU 2 sampling and analytical procedures. Development of any new procedures will be the responsibility of the Planning Group within the Environmental section of CRU2. New procedures will be submitted to EPA for approval, as exceptions or addenda to the SCQ.

3. Prepare a Sampling and Analysis Plan (SAP) per CERCLA guidance for conducting field investigations, sampling, and analytical tasks. Development of the SAP will be the primary responsibility of the Planning Group within the Environmental section of CRU2. Each SAP will be provided to the U.S. EPA and the Ohio EPA for their information before sampling activities are initiated.

4. Conduct the field program in accordance with the SCQ, established procedures, and the SAP, including all aspects of monitoring, sampling, and shipment of samples. The FERMCO Site Characterization/Data Management Department will provide the necessary matrixed support to CRU2 to ensure completion of these tasks.

5. Review and validate data collected during field sampling/field characterization program. This task will be conducted by the Data Management Group of the Environmental section matrixed to CRU2, on an ongoing basis throughout the data collection and reporting processes. These tasks will be performed in accordance with the approved SCQ data validation procedures. Validated data will be entered into the FEMP RI/FS database.

6. Assess and evaluate the field characterization data to verify attainment of the data quality objectives of the Work Plan. Various facets of this task will be the responsibility of various groups within the Environmental section of CRU2, including the Planning Group, the Remedial Investigation Group, and the Data Management Group.

5.0 HEALTH AND SAFETY CONSIDERATIONS

The most successful methodology for providing an effective health and safety program for any activity is to ensure that involved personnel have received adequate training prior to implementation of the field work. Employee awareness of all physical, radiological, and chemical hazards which may be encountered will be accomplished by training throughout the planning and execution of this project.

All FEMP employee and subcontractor personnel who will be performing field work during this project will be required to have participated in all Occupational Safety and Health Administration (OSHA) mandated 1910.120 Hazardous Waste Site Worker training. In addition, all applicable annual refresher training will have been taken by the individuals.

U.S. DOE regulations at the FEMP require a series of site specific training courses. These courses are designed to augment OSHA required training and provide additional training specific to the hazards which exist at the FEMP.

Field personnel participating in the performance of this project will be trained to the SCQ requirements, the FEMP Health and Safety Plan, and the Task Specific Health and Safety Plans.

In summary, employee awareness and clearly delineated lines of authority and responsibility have been designed to provide for effective health and safety related knowledge specific to each activity.

5.1 TASK SPECIFIC PLANS

All aspects of this Sampling and Analysis Plan will be performed in accordance with all existing applicable U.S. DOE, U.S. EPA, OSHA, and State of Ohio health and safety regulations. Additionally, all practices will be managed in accordance with commonly accepted practices used in the hazardous wastes industry.

Prior to the implementation of field work which involves drilling, trenching or soil boring, a "Penetration Permit" will be obtained. Before a Penetration Permit is obtained, the area of concern is investigated and compared against the site database for underground utilities in the area. No drilling, trenching or soil borings will be performed without a valid Penetration Permit being obtained prior to actual performance of the field work.

Because of the proposed K-65 Trench sampling, a Confined Space Entry Permit will be necessary. This will be coordinated with FEMP Health and Safety staff and obtained prior to any entry or sampling being performed.

Field activities to be performed each have a separate task-specific health and safety plan. Task specific health and safety plans have been prepared in accordance with the FEMP Site Health and Safety Plan. For each project task and sub-task, health and safety technician coverage is provided by the assignment of a technician to monitor the field crew's activities. Project specific health and safety plans provide for the hazards typically encountered by personnel when performing the specified field work.

Existing task specific health and safety plans to be utilized for this project include:

- "Health and Safety Plan for Sampling of Wells and Surface Water Performed in Support of Sampling at the FEMP".
- "Health and Safety Plan for Surface Sampling Tasks Performed in Support of Sampling at the FEMP".
- "Health and Safety Plan for Well Drilling and Soil Boring Operations Performed in Support of Sampling at the FEMP".

Tasks not covered by the existing plans will have specific health and safety planning documents prepared, or existing documents will be revised as needed. Proper equipment to be used for health and safety monitoring and personnel protection are specified. Criteria for the selection of monitoring equipment and protective clothing are detailed.

Each member of the field crews is required to participate in a health and safety training session which is specific to each field project, prior to performance of the field work.

5.2 RADIOLOGICAL MONITORING AND CONTROLS

Radiological monitoring for this work plan will be achieved using existing institutional controls commonly utilized at the FEMP. For those areas of the FEMP which are under existing institutional radiological controls, any employee who will be entering such areas is required to possess and wear a Thermal Luminescent Detector (TLD) to monitor for exposure to radiological contamination. In addition, each employee is required to participate in a regularly scheduled urine analysis program which is designed to monitor for radiological exposure.

For areas which are subject to more restrictive radiological controls (i.e. the potential for exposure is greater) Radiation Worker Permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological technician will be assigned to each field crew performing any activities in an area which could result in site workers being exposed to levels of radiological contamination exceeding DOE requirements.

Ingress and egress of personnel, equipment and vehicles to and from radiologically controlled areas will be monitored with "real time" radiation detection instrumentation.

Monitoring results which exceed FEMP determined exposure guidelines will be further evaluated as to the possible source(s). Measures necessary to remediate radiological contamination sources will be implemented. Such measures may include, but are not limited to, personnel training, decontamination, employee exposure monitoring, increased personnel monitoring, Personnel Protective Equipment, and sampling of suspect materials encountered.

If the responsible radiological technician assigned to the field activities being performed identifies a real or potential condition which could or will result in an unsafe condition, then that person has the responsibility to cease field operations until such time as the unsafe condition has been corrected.

5.3 NONRADIOLOGICAL MONITORING AND CONTROLS

Monitoring of potential health and safety problems associated with nonradiological hazards are evaluated by a health and safety technician. Also, all field crews are responsible for hazard awareness and recognition. Task specific training is designed to enhance the performance of all field work using good and safe work practices.

Evaluating the potential for personnel exposure to organic contaminants will be achieved mainly through the use of an Hnu PI-101 Photoionization Detector. Other equipment which could potentially be used include Drager Tubes, oxygen meters and combustible gas indicators.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The primary objectives of the quality assurance and quality control sections of this plan relate to the collection of field information and data which are sufficient to more accurately characterize the relationship between the wastes existing at the OU 2 areas of interest, and the potential for off-site contaminant migration. Specific objectives of this field sampling effort will be designed, organized and implemented in a manner which will optimize the collection of information which meets predetermined data quality objectives. To ensure that information is gathered in such a manner that data quality objectives are met, quality control measures will be used to determine conformance with overall OU 2 RI/FS program objectives.

The fundamental mechanisms that will be used to achieve these project quality goals can be categorized as prevention, assessment, and correction. These components are further described as follows:

1. Prevention of defects in the data quality through planning and design, documented instructions and procedures, and careful selection and training of skilled, qualified personnel.

2. Quality assessment through a program of regular audits and surveillances to supplement continual informal review.

3. Permanent correction of conditions adverse to quality objectives through a close-looped corrective action system.

6.1 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field quality control samples will be taken to evaluate the possibility that some controllable practice, such as decontamination, or sampling technique may be responsible for introducing bias in project analytical results. Five types of QC samples will be collected: sampling equipment rinsates, trip blanks, field blanks, preservative blanks and duplicate samples.

Refer to Section 4.1 of the SCQ for details.

6.2 ACCURACY, PRECISION, AND SENSITIVITY

For the purposes of this Sampling and Analysis Plan, Accuracy, Precision, and Sensitivity are defined in the following manner:

Accuracy and Precision - accurate and precise data will be achieved through the use of sampling and analysis procedures that minimize biases, through the use of standard procedures, through the meticulous calibration of field and analytical equipment, and by implementing corrective action whenever measured accuracy and precision exceed pre-established limits.

Accuracy and precision will be measured by the analysis and implementation of field and analytical methodologies which ensure repeatability.

Sensitivity - Sensitivity will be achieved by close monitoring of all field activity components, sub-components and associated quality control mechanisms. Quality assurance through effective quality control program implementation should ensure that project data quality objections are met.

Refer to Section 4.2 of the SCQ for additional detail.

6.3 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

For the purposes of this Sampling and Analysis Plan, Completeness, Representativeness, and Comparability are defined in the following manner:

Completeness - a sufficient number of successful (valid) measurements must be obtained to characterize the extent and nature of sediment, soil, subsoil, perched water, groundwater, and surface water contamination, resulting from wastes disposal practices within OU 2.

Representativeness - the extent to which reported analytical results factually depict the chemistry of the sampled environmental media. Representativeness is optimized through proper selection of investigation locations, sampling sites and intervals, proper sample handling and analysis.

Comparability - the extent to which comparisons among separate measurements will yield valid conclusions. Comparability among measurements in the remedial investigation will be achieved through the use of rigorous standard field installation, sampling, document control, data reporting, and analytical procedures.

Refer to Section 4.3 of the SCQ for additional detail.

6.4 TRAINING, RECORDS ADMINISTRATION, AND DOCUMENT CONTROL

All FEMP employees and subcontractors assigned to this project will be required to participate in a series of regularly scheduled training sessions which are designed to enhance employee awareness of each one's responsibilities and duties in the project. Field staff will receive comprehensive project and task specific training. Project daily "Tailgate Safety Meetings" will augment health and safety and project objectives training prior to the project start.

Refer to Section 4.4 of the SCQ for additional details.

6.5 PERFORMANCE AND SYSTEM AUDITS

To verify compliance with SCQ and project-specific requirements, the FEMP project manager and designated FEMP QA organization shall be responsible for scheduling and conduction QA audits and surveillance. Audit results of activities covered by the SCQ are available to the EPA upon request to DOE/FN. EPA may conduct external audits of FEMP activities covered by the 1991 amended Consent Agreement as required.

As a minimum, audits shall consist of evaluation of the QA program and procedures, effectiveness of the implementation, and review of associated project documentation. Audits shall cover applicable laboratory activities, field operations and documentation and final reports. Auditing shall be performed in accordance with DOE guidelines, the SCQ and applicable Project-Specific Plans (PSP).

As a minimum, surveillance shall consist of monitoring/observing ongoing project activity and work areas to verify item and activity conformance to specified requirements. Surveillance shall be scheduled, planned, and documented.

Reference Section 12 of the SCQ for further details.

7.0 FIELD ACTIVITY GUIDELINES

7.1 FIELD ACTIVITIES

This section presents a generalized description of the field activities to be used to provide the additional contaminant nature and extent information necessary for RI/FS purposes. Field activities will consist of various non-intrusive geophysical and radiological surveying, and intrusive sampling of soil, subsurface soil, waste material, surface and, groundwater media. This will be accomplished by the installation of a series of soil borings and monitoring wells, the hand augering of numerous soil, bucket augering of waste samples, and the collection of surface and groundwater samples.

Procedures to be used during the performance of the field operations are derived from several FEMP program plans, procedures, and U.S. EPA sources. FEMP program plans, specifically the "FEMP Sitewide CERCLA Quality Assurance Project Plan" (SCQ), "FEMP RI/FS QAPP", "FEMP RI/FS Work Plan", and FEMP Site Characterization/Data Management Department and Environmental Monitoring Section Standard Operating Procedures will be used as guidance documents. U.S. EPA procedure reference sources include; "Compendium of Superfund Field Operations Methods" and "Hazardous Waste Site Disposal Operations". Guidance for field activities is presented in Section 7.2 below.

For those field activities which are not adequately proceduralized, field activity-specific procedures will be presented. Those procedures will be in accordance with commonly accepted investigative techniques, and in some instances will be derived from recognized industry sources.

7.2 FIELD OPERATIONS PROCEDURES

TABLE 7-1
REFERENCE GUIDELINES

Administrative Procedures	Reference Document
Chain of Custody	SCQ Volume I, Section 7.1; ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-401, Section 5.1.12;
Corrective Action	SCQ Volume I, Section 15.2; ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-210
Daily Logs	SCQ Appendix J, Subsection J.4.1; QAPP Volume V, Subsection 5.3
Variances	SCQ QAPP Volume I, Section 15.4.1 ASI/IT RI/FS Fernald Project Policy and Procedures Manual FPP-203

Administrative Procedures	Reference Document
Document Change Request	SCQ Volume I, Section 4.4.3.2 QAPP Volume V, Section 15.4.2 ASI/IT RI/FS Fernald Project Policy and Procedures Manual FPP-200
Field Procedures	**Reference Document**
General Drilling Practices	SCQ, Section 5.2.1; Appendix J, Subsection J.4.2; RI/FS QAPP Volume V, Subsection 5.2
Subsurface Soil Sampling	SCQ, Appendix K, Subsection K.5.3; RI/FS QAPP Volume V, Subsection 6.6
Monitoring Well/Piezometer Design, Installation, and Abandonment	SCQ, Section 5.2.2; Appendix J, Subsection J.4.3; EM-GW-004; RI/FS QAPP Volume V, Subsection 5.3
Well Development	SCQ, Appendix J; Subsection J.4.4; RI/FS QAPP Volume V, Subsection 5.4
Field Screening of Samples for Radioactive Contamination	SCQ, Appendix K, Subsection K.5.3.2; RI/FS QAPP Volume V, Section 6.6.2; ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-600
Decontamination	SCQ, Appendix K, Subsection K.11; RI/FS QAPP Volume V, Subsections 5.2, 5.4, and 6.6.1
Sample Handling/Laboratory Procedures	**Reference Document**
Grain Size Analysis	Attachment I, Volume V, Method No. FM-GTT-0031
Classification, Transportation, and Shipment of FEMP RI/FS Samples	ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-601; SCQ, Appendix K, Subsection K.10; Volume I, Subsection 6.7; Compendium of Superfund Field Operations Methods Section 6.0; RI/FS QAPP Volume V, Subsection 6.8 and 6.0

TABLE 7-2
GROUNDWATER SAMPLING PROCEDURES

Administrative Procedures	Reference Document
See TABLE 1	See TABLE 1
Field Procedures	**Reference Document**
General Groundwater Purging and Sampling Techniques	RI/FS QAPP Volume V, Subsection 6.1; SCQ Volume I, Subsection 6.2; SCQ Appendix K Subsection K4.2, EM-GW-005
Water Level Measurements	SCQ Volume I, Section 6.2.2.1; SCQ Appendix K, Subsection K.4.2.1; RI/FS QAPP Volume V, Subsection 6.1.2
Field Analytical Methods	SCQ Appendix K, Subsection K.4.1; SCQ Volume I, Subsection 6.2; RI/FS QAPP Volume V, Subsection 6.2
Parameter-Specific Sampling Procedures	SCQ Appendix K, Subsection K.4.2.3; SCQ Volume I, Subsection 6.2.2.3; RI/FS QAPP Volume V, Subsection 6.1.1
Decontamination	EM-GW-009; RI/FS QAPP Volume V, Section 6.1; SCQ Appendix K, Subsection K.11
Sample Handling/Laboratory Procedures	**Reference Document**
Classification, Transportation and Shipment of FEMP RI/FS Samples	See TABLE 1

TABLE 7-3
SURFACE WATER SAMPLING PROCEDURES

Administrative Procedures	Reference Document
See TABLE 1	See TABLE 1
Field Procedures	**Reference Document**
General Surface Water Sampling Techniques	RI/FS QAPP Volume V, Subsection 6.3; SCQ Appendix K, Subsection K.4.3; Compendium of Superfund Field Operations Methods, Section 10.2.6.2
Field Analytical Methods	SCQ Appendix K, Subsection K.4.1; SCQ Volume I Subsection 6.2.3; RI/FS QAPP Volume V, Section 6.3
Parameter Specific Sampling Procedures	SCQ Appendix K, Subsection K.4.3.3; RI/FS QAPP Volume V, Section 6.1.1
Decontamination	See TABLES 1 and 2
Sample Handling/Laboratory Procedures	**Reference Document**
Classification, Transportation and Shipment of FEMP RI/FS Samples	See TABLE 1

TABLE 7-4
TRENCHING PROCEDURES

Administrative Procedures	Reference Document
See TABLE 1	See TABLE 1
Field Procedures	**Reference Document**
General Trenching Techniques	Phase II, OU 2 Work Plan
Field Screening of Samples for Radioactive Contamination	ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-600; SCQ Appendix K, Subsection K.5.3.2; RI/FS QAPP Volume V, Subsection 6.6.2
Decontamination	SCQ Appendix K, Subsection K.11; RI/FS QAPP Volume V, Subsection 6.6.1
Sample Handling/Laboratory Procedures	**Reference Document**
Classification, Transportation, and Shipment of FEMP RI/FS Samples	See TABLE 1

TABLE 7-5
SOIL GAS SURVEY PROCEDURES

Administrative Procedures	Reference Document
See TABLE 1	See TABLE 1
Field Procedures	**Reference Document**
General Soil Gas Survey Procedures	DCR #69, Revision A, 8/92; Phase II OU 2 Work Plan
Decontamination	DCR #69, Revision A, 8/92; Phase II OU 2 Work Plan
Sample Handling	Phase II OU 2 Work Plan; Analabs, A Unit of Foxboro Analytical, "Operating and Service Manual for Century Systems, Portable Organic Vapor Analyzer (OVA) Model OVA-128 and Optional Accessories, Revision C"

TABLE 7-6
GEOPHYSICAL SURVEYING PROCEDURES

Administrative Procedures	Reference Document
Corrective Action	See TABLE 1
Daily Logs	See TABLE 1
Variances	See TABLE 1
Document Change Request	See TABLE 1
Field Procedures	**Reference Document**
General Geophysical Surveying Techniques	Phase II OU 2 Work Plan; SCQ Appendix J, Subsection J.4.5.2; Compendium of Superfund Field Operations Methods, Subsections 8.4.2.1 and 8.4.2.4, Appendices 8.4A and 8.4D
Sample Handling/Laboratory Procedures	**Reference Document**
N/A	N/A

TABLE 7-7
WASTE SAMPLING PROCEDURES

Administrative Procedures	Reference Document
See TABLE 1	See TABLE 1
Field Procedures	**Reference Document**
General Drilling Practices	RI/FS QAPP Volume V, Section 5.2; SCQ Section 5.2.1, Appendix J, Section J.4.2
Subsurface "Soil" Sampling	RI/FS QAPP Volume V, Section 6.6; SCQ Appendix K, Section K.5.3
Surface "Soil" Sampling	SCQ Appendix K, Section K.5.1; RI/FS QAPP Volume V, Section 6.4
Field Screening of Samples for Radioactive Contamination	SCQ Appendix K, Section K.11; RI/FS QAPP Volume V, Section 6.6.2; ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-600
Decontamination	See TABLE 1
Field Storage and Shipment of Samples	See TABLE 1
Sample Handling/Laboratory Procedures	**Reference Document**
Classification, Transportation, and Shipment of FEMP RI/FS Samples	See TABLE 1

8.0 FIELD SAMPLING PLAN

8.1 SAMPLE TEAM ORGANIZATION

8.1.1 Organizational Structure

Sampling for this project will be performed by the Site Characterization/Data Management Department (SC/DM) of the FERMCO Environmental Management Division. A schematic presentation of the SC/DM and OU 2 organization is provided in Figure 8-1. Due to the nature, objectives and programmatic requirements of this project, actual sampling locations and analysis parameter selection is designated by FERMCO personnel of OU 2.

Field sampling crews will be directly supervised by the SC/DM Field Operations Manager. Sampling will be accomplished by two person field crews, consisting of sampling technician personnel.

Additional sampling custodian staff will be utilized to provide an interface between the sampling crews and the FEMP or contract laboratory to be used for sampling analysis.

8.1.2 Responsibilities of Team Members

The field coordinator is responsible for the coordination and effective use of all personnel on site and for proper maintenance of the record of all field activities. In addition, the field coordinator is responsible for field quality control including issuance and tracking of measurement and test equipment.

Field sampling personnel are responsible for the collection of the samples in accordance with the approved Sampling and Analysis Plan. All activities associated with the execution of sampling are to be documented on the appropriate Field Activity Daily Logs (FADLs) which are to be completed, by the sampling technicians, for each location. These technicians are also responsible for ensuring that the proper sampling equipment is available and in serviceable condition. Also, proper decontamination of equipment between each sampling point is the responsibility of these staff.

Additional sampling custodian staff who interface with the FEMP or contract laboratory are responsible for ensuring that proper sampling containers, preservatives and sampling coolers are available and in serviceable condition.

Also, sample labeling, handling, storage and sample required paperwork in the form of a Request for Analysis/Chain of Custody (RFA/CC) Form to be completed prior to submittal to the appropriate FEMP or contractor laboratory for analysis, are the responsibility of the sampling custodian. Finally, sampling custodians are responsible for logging in all collected samples, delivering the samples to the FEMP laboratory or sending the samples, with accompanying paperwork, to the contract laboratory.

8.1.3 Sampling Schedule

Sampling will be accomplished according to the schedule contained in the approved work plan and Section 9.0 of this SAP. In general, sampling will be performed concurrent with other investigative activities such as well drilling, soil boring and trenching.

Groundwater sampling will consist of Hydropunch ™ sampling in boreholes and sampling of existing or newly installed monitoring wells. New monitoring wells will be sampled following completion of well development.

8.2 SAMPLE TYPE LOCATION AND ANALYSES

The RI sampling objectives were presented in Section 3.1 followed by the DQO rationale and ASL levels in Section 3.2. This section summarizes the proposed samples to be collected, the proposed sample locations, and the analytical requirements for each subunit in OU 2. The remainder of this section is organized as follows:

- Solid Waste Landfill
    - Summary of Sample Types, Table 8-1
    - Sample Location Map, Figures 8-2, 8-3
    - Sample Analysis Summary, Table 8-2
- Lime Sludge Pond
    - Summary of Sample Types, Table 8-3
    - Sample Location Map, Figure 8-4
    - Sample Analysis Summary, Table 8-4
- Active Flyash Pile
    - Summary of Sample Types, Table 8-5
    - Sample Location Map, Figure 8-5
    - Sample Analysis Summary, Table 8-6
- Inactive Flyash Pile

- Summary of Sample Types, Table 8-7
- Sample Location Map, Figures 8-6, 8-7
- Sample Analysis Summary, Table 8-8

• South Field

- Summary of Sample Types, Table 8-9
- Sample Location Map, Figure 8-8
- Sample Analysis Summary, Table 8-10

Sample collection methods and field and analytical methods and procedures are discussed in the following sections.

TABLE 8-1
SOLID WASTE LANDFILL
PROPOSED SAMPLING SUMMARY(1)

Source of Sample	Number of Locations	Location/ Description	Sample Media	No. of Samples per Location	No. of Samples(2)	Sample Interval	Sample Parameters
SURFACE	12	Within fenced area	Soil	1	12	0-6 in.	Full HSL and rad.
SURFACE WATER/ SEDIMENT	2	North Drainageway	SW(3) Sediment	1 1	2 2	N/A(4) 0-6 in.	Full HSL and rad.
SOIL GAS SURVEY	33	50'x 40'Grid within the fenced area	Organic Vapor	1	33	2-5 feet depth	Organic Vapor FID(5)
BORINGS	Waste Cells 10 to 15 Evaporation Pond 2 to 4	6 to 20 feet deep 8 to 10 feet deep	Waste Soil Waste Soil Soil	1 1 1 1 1	10 to 15 10 to 15 2 to 4 2 to 4 2 to 4	- screening based - 5 ft. below waste - screening based - 5 ft. below waste - waste/soil interface	Full HSL and rad.
MONITORING WELLS (new/exist)	13	1000-Series 2000-Series	GW(6)	1 1	2/4 4/3	N/A	Full HSL and rad.

(1) Routine field and on-site screening samples not included
(2) QC samples not included
(3) surface water
(4) not applicable
(5) Flame Ionization Detector
(6) groundwater

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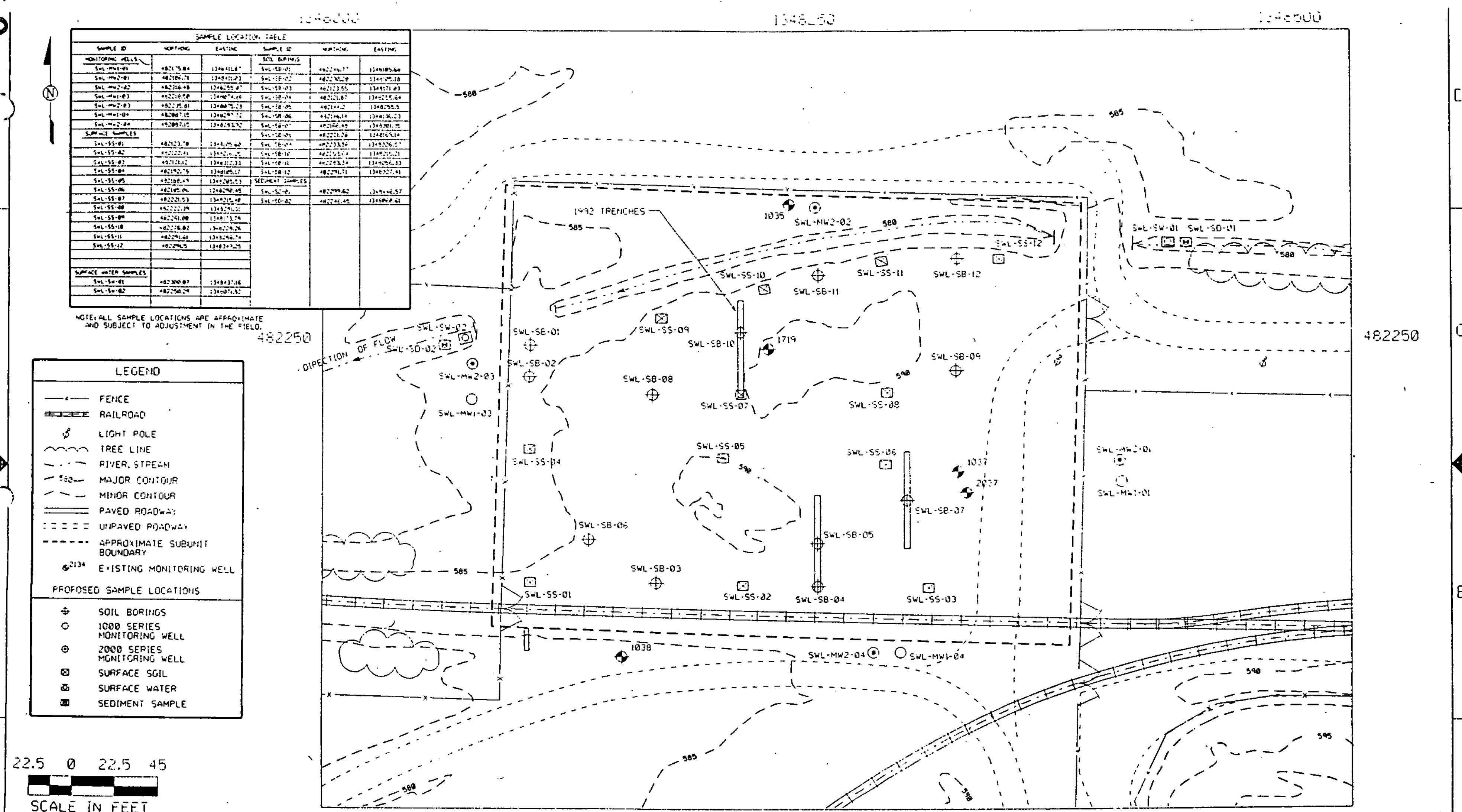

SAMPLE LOCATION TABLE

SAMPLE ID	NORTHING	EASTING	SAMPLE ID	NORTHING	EASTING
MONITORING WELLS			SOIL BORINGS		
SWL-MW1-01	482175.84	[illegible]	SWL-SB-01	482246.77	1348105.60
SWL-MW2-01	482186.71	1348411.83	SWL-SB-02	482230.20	1348105.18
SWL-MW2-02	482316.40	1348255.47	SWL-SB-03	482123.55	1348171.03
SWL-MW1-03	482210.50	1348074.66	SWL-SB-04	482121.87	1348255.64
SWL-MW2-03	482235.81	1348075.23	SWL-SB-05	482144.2	1348255.5
SWL-MW1-04	482087.15	[illegible]	SWL-SB-06	482146.14	1348136.23
SWL-MW2-04	482097.15	[illegible]	SWL-SB-07	482166.49	1348301.35
SURFACE SAMPLES			SWL-SB-08	482221.26	1348169.14
SWL-SS-01	482123.70	[illegible]	SWL-SB-09	482233.56	[illegible]
SWL-SS-02	482122.41	[illegible]	SWL-SB-10	[illegible]	1348215.21
SWL-SS-03	482121.12	[illegible]	SWL-SB-11	[illegible]	1348256.33
SWL-SS-04	482192.75	1348105.12	SWL-SB-12	482291.71	1348327.41
SWL-SS-05	482160.43	[illegible]	SEDIMENT SAMPLES		
SWL-SS-06	482165.06	1348298.45	SWL-SD-01	482299.62	1348446.57
SWL-SS-07	482221.53	1348215.40	SWL-SD-02	482246.45	1348060.61
SWL-SS-08	482222.39	1348291.31			
SWL-SS-09	482251.00	1348173.79			
SWL-SS-10	482276.02	1348225.76			
SWL-SS-11	482291.61	1348290.74			
SWL-SS-12	482296.5	1348349.25			
SURFACE WATER SAMPLES					
SWL-SW-01	482300.07	1348437.16			
SWL-SW-02	482250.29	1348074.52			

NOTE: ALL SAMPLE LOCATIONS ARE APPROXIMATE AND SUBJECT TO ADJUSTMENT IN THE FIELD.

LEGEND

- FENCE
- RAILROAD
- LIGHT POLE
- TREE LINE
- RIVER, STREAM
- 580 MAJOR CONTOUR
- MINOR CONTOUR
- PAVED ROADWAY
- UNPAVED ROADWAY
- APPROXIMATE SUBUNIT BOUNDARY
- 2134 EXISTING MONITORING WELL

PROPOSED SAMPLE LOCATIONS

- SOIL BORINGS
- 1000 SERIES MONITORING WELL
- 2000 SERIES MONITORING WELL
- SURFACE SOIL
- SURFACE WATER
- SEDIMENT SAMPLE

22.5 0 22.5 45

SCALE IN FEET

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REF. NO.:	DATE:	APPROVED:	DATE:

DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHS.

NOTES: WELLS 1027, 2027, 1052, 2052 ARE NOT SHOWN, BUT WILL BE SAMPLED
PROPOSED WELL SWL-MW2-04 TO BE INSTALLED ONLY IF GRADIENT ANALYSIS INDICATES FLOW TO THE SOUTH.
PROPOSED WELL SWL-MW1-01 TO BE INSTALLED ONLY IF EXISTING WELL 1037 IS ABANDONED.
COORDINATES ARE IN STATE PLANE NAD 1983.

DRAFTER:	WILLIAMS
DESIGN FILE:	d110011.dgn
DEPARTMENT:	G.I.S.
DWG. NO.:	d11-0011
DATE:	3-8-93

REV 1

FIGURE 8-2
SOLID WASTE LANDFILL
PROPOSED SAMPLE LOCATIONS

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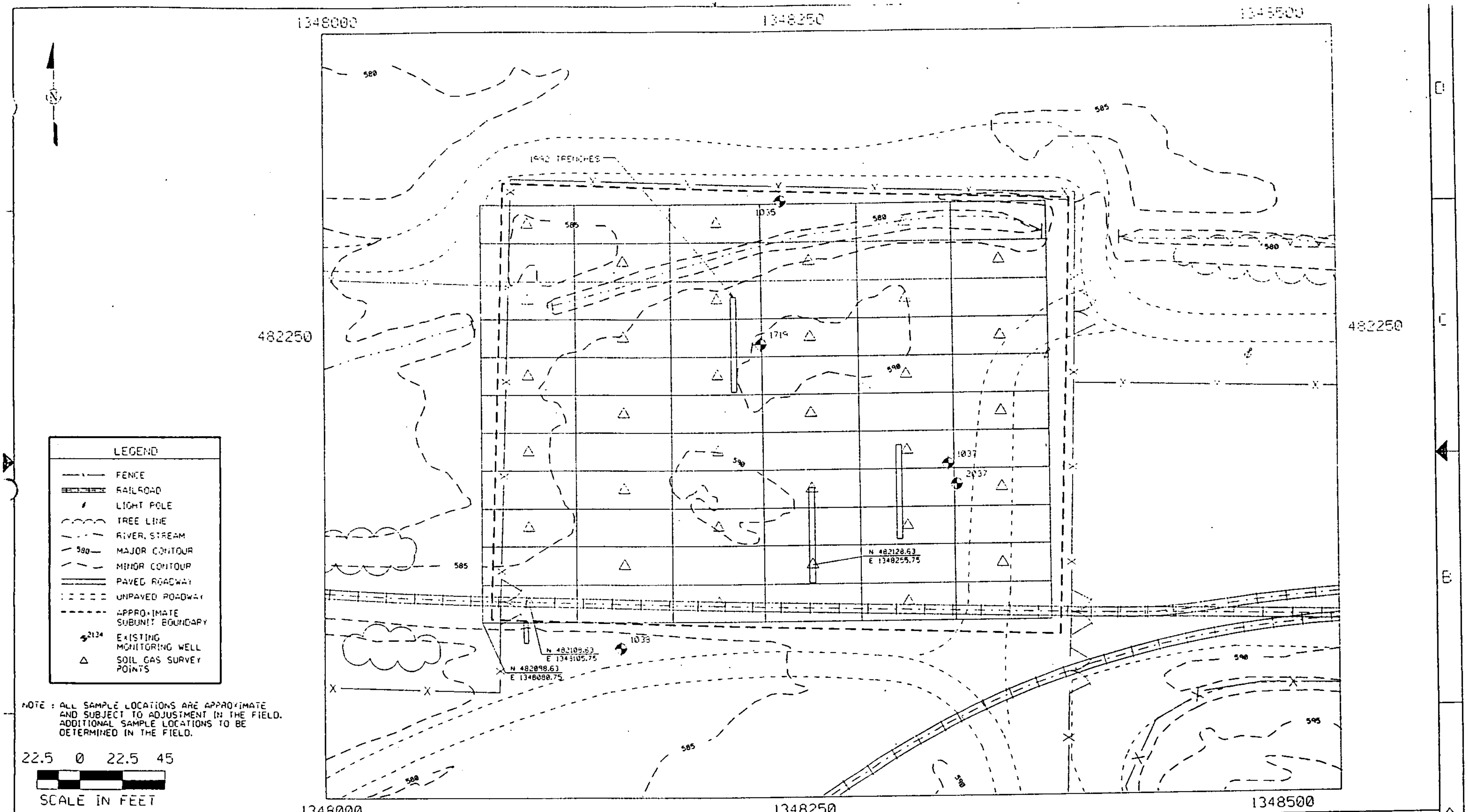

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DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHY

NOTES: WELLS 1027,2027,1052,2052 ARE NOT SHOWN
GRID DISTANCE IS EAST 50', NORTH 20' STARTING AT E 1348080.75, N 482098.63
GRID IS ORIENTED NORTH-SOUTH.
ADDITIONAL SAMPLING TO BE FIELD LOCATED. BASED UPON TEST RESULTS.
COORDINATES ARE IN STATE PLANE NAD 1983.

DRAFTER:	WILLIAMS
DESIGN FILE:	c110013.dgn
DEPARTMENT:	G.I.S.
DWG. NO.:	c11-0013
DATE:	3-4-92

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FIGURE 8-3
SOLID WASTE LANDFILL
PROPOSED SOIL GAS SURVEY

TABLE 8-2
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE SOLID WASTE LANDFILL

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
GROUNDWATER SAMPLES[1]					
SWL-MW1-01		B	B	A	
SWL-MW2-01		B	B	A	
SWL-MW2-02		B	B	A	
SWL-MW1-03		B	B	A	
SWL-MW2-03		B	B	A	
SWL-MW1-04		B	B	A	
SWL-MW2-04		B	B	A	
SOIL BORINGS FOR MONITORING WELLS					
SWL-MW1-01 - 8	8 - 10			A	[D], UC
SWL-MW2-01				A	
SWL-MW2-02 - 4	4 - 6			A	[D], UC
SWL-MW2-02 - 14	14 - 16			A	[D], UC
SWL-MW1-03 - 4	4 - 6			A	[D], UC
SWL-MW1-03 - 10	10 - 12			A	[D], UC
SWL-MW2-03				A	
SWL-MW1-04 - 6	6 - 8			A	[D], UC
SWL-MW1-04 - 14	14 - 16			A	[D], UC
SWL-MW2-04				A	
SURFACE SAMPLES					
SWL-SS-01	0 - 0.5	C	C		
SWL-SS-02	0 - 0.5	C	C		
SWL-SS-03	0 - 0.5	C	C		
SWL-SS-04	0 - 0.5	C	C		
SWL-SS-05	0 - 0.5	C	C		
SWL-SS-06	0 - 0.5	C	C		

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TABLE 8-2
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE SOLID WASTE LANDFILL

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SURFACE SAMPLES (CONT.)					
SWL-SS-07	0 - 0.5	C	C		
SWL-SS-08	0 - 0.5	C	C		
SWL-SS-09	0 - 0.5	C	C		
SWL-SS-10	0 - 0.5	C	C		
SWL-SS-11	0 - 0.5	C	C		
SWL-SS-12	0 - 0.5	C	C		
SEDIMENT SAMPLES					
SWL-SD-01	0 - 0.5	C	C		
SWL-SD-02	0 - 0.5	C	C		
SURFACE WATER SAMPLES					
SWL-SW-01[3]		B	B[2]	A	
SWL-SW-02		B	B	A	
SOIL BORINGS					
SWL-SB-01 - 2	2 - 4	C	C	A	[D]
SWL-SB-01 - 5	5 - 5.5	C	C	A	
SWL-SB-01 - 7	7 - 7.5	C	C	A	
SWL-SB-02 - 2	2 - 2.5	C	C	A	
SWL-SB-02 - 4	4 - 6	C	C	A	[H]
SWL-SB-02 - 7	10 - 12	C	C	A	[D], [F]
SWL-SB-03 - 1	1 - 3	C	C	A	[D]
SWL-SB-03 - 4	4 - 4.5	C	C	A	
SWL-SB-03 - 4.5	4.5 - 5.5			A	[D], [E]

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TABLE 8-2
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE SOLID WASTE LANDFILL

		ANALYTES			
SAMPLE ID	ESTIMATED DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SWL-SB-04 - 4	4 - 4.5	C	C	A	
SWL-SB-04 - 12	12 - 12.5			A	
SWL-SB-05 - 5.5	5.5 - 7.5	C	C	A	[H]
SWL-SB-05 - 12	12 - 12.5	C	C	A	
SWL-SB-05 - 12.5	12.5 - 14.5	C	C	A	[D], [F]
SWL-SB-06 - 4	4 - 6	C	C	A	[H]
SWL-SB-06 - 12	12 - 12.5	C	C	A	
SWL-SB-07 - 7	7 - 7.5	C	C	A	
SWL-SB-07 - 13	13 - 13.5			A	
SWL-SB-07 - 13.5	13.5 - 15.5	C	C	A	[D]
SWL-SB-08 - 4	4 - 4.5	C	C		
SWL-SB-08 - 6.5	6.5 - 8.5				[D], [E]
SWL-SB-08 - 12	12 - 12.5	C	C		
SWL-SB-09 - 1	1 - 3				[D]
SWL-SB-09 - 7	7 - 7.5	C	C		[D]
SWL-SB-09 - 6.5	6.5 - 8.5				[D], [E]
SWL-SB-09 - 11.5	11.5 - 13.5				[H]
SWL-SB-09 - 16	16 - 18	C	C		[D], [E], [F]
SWL-SB-010 - 5.5	5.5 - 7.5	C	C		[H]
SWL-SB-010- 13	13 - 13.5	C	C		
SWL-SB-011 - 2	2 - 4				[D]
SWL-SB-011 - 3	4 - 6	C	C		[D]
SWL-SB-11 - 10	10 - 10.5				
SWL-SB-11 - 17	17 - 17.5	C	C		
SWL-SB-12	10 - 10.5	C	C		
SWL-SB-12	17 - 17.5	C	C		

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NOTES

(1) Seven existing monitor wells will also be sampled. These include wells, 1035, 1037, 1038, 1719, 2027, 2037, 3037.

(2) Screening rad on water samples by laser phosphorimetry.

(3) Spring samples if collected in drainage, to be sent for on-site screening per the SAP.

(4) Screening rad on soil samples by X-ray fluroescence.

(5) Soil borings estimated at 10-15 for the Solid Waste Landfill Soil boring number 01 and 02 are intended to investigate the trench/evaporation pond area in the northwest corner of the landfill.

TARGET ANALYTE LIST 20.03.05 A through I

[A] Water/Soil - total Uranium

[B] Groundwater/Surface Water - Full HSL, Full Rad., Misc. Rad., Gen Groundwater Quality

[C] Soil/Sediment/Sludge/Waste - Full HSL, Full Rad., Misc. Rad.

[D] Classification Tests

SG = Specific Gravity
W = Water Content
γd = dry unit weight
LL = liquid limit
PL = plastic limit
Grain Size
SA = Sieve Analysis
HA = Hydrometer Analysis

[E] Con = Consolidation test

[F] HC = Hydraulic Conductivity

Strength Tests

[G] UC = Unconfined Compression
CIU = Consolidated Isotropic Undrained
DS = Direct Shear

[H] TCLP (Toxicity List)

[I] TCLP plus Cu, Fe, Mn, Zn

TABLE 8-3
LIME SLUDGE PONDS
PROPOSED SAMPLING SUMMARY(1)

Source of Sample	Number of Locations	Location/ Description	Sample Media	No. of Samples per Location	No. of Samples(2)	Sample Interval	Sample Parameters
SURFACE	4 6 7 2	inside ponds outside ponds berm roadway	Waste Soil Soil Soil	1 2 1 1	4 12 7 2	0-6 in. 0-6 & 6-12 in. 6-12 in. 0-6 in.	Full HSL and rad.
SURFACE WATER	1	North Pond	SW(3)	1	1	N/A(4)	Full HSL and rad.
BORINGS	8 (4 borings each pond)	10-25 feet	Soil/ waste	2-3	18(5)	-2 ft depth (4 borings) -5 ft depth (4 borings) -2 ft below fill (8 borings) -5 ft below fill (2 borings)	Full HSL and rad.
TRENCH	4 2	K-65 Slurry Trench	soil residue	1 1	4 2	N/A	Full HSL and rad.
MONITORING WELLS (new/exist)	14	1000-Series 2000-Series	GW(6) GW	1 1	3/7 3/1	N/A	Full HSL and rad.

(1) Routine field and on-site screening samples not included
(2) QC samples not included
(3) surface water
(4) not applicable
(5) based on screening results, additional soil samples may be taken
(6) groundwater

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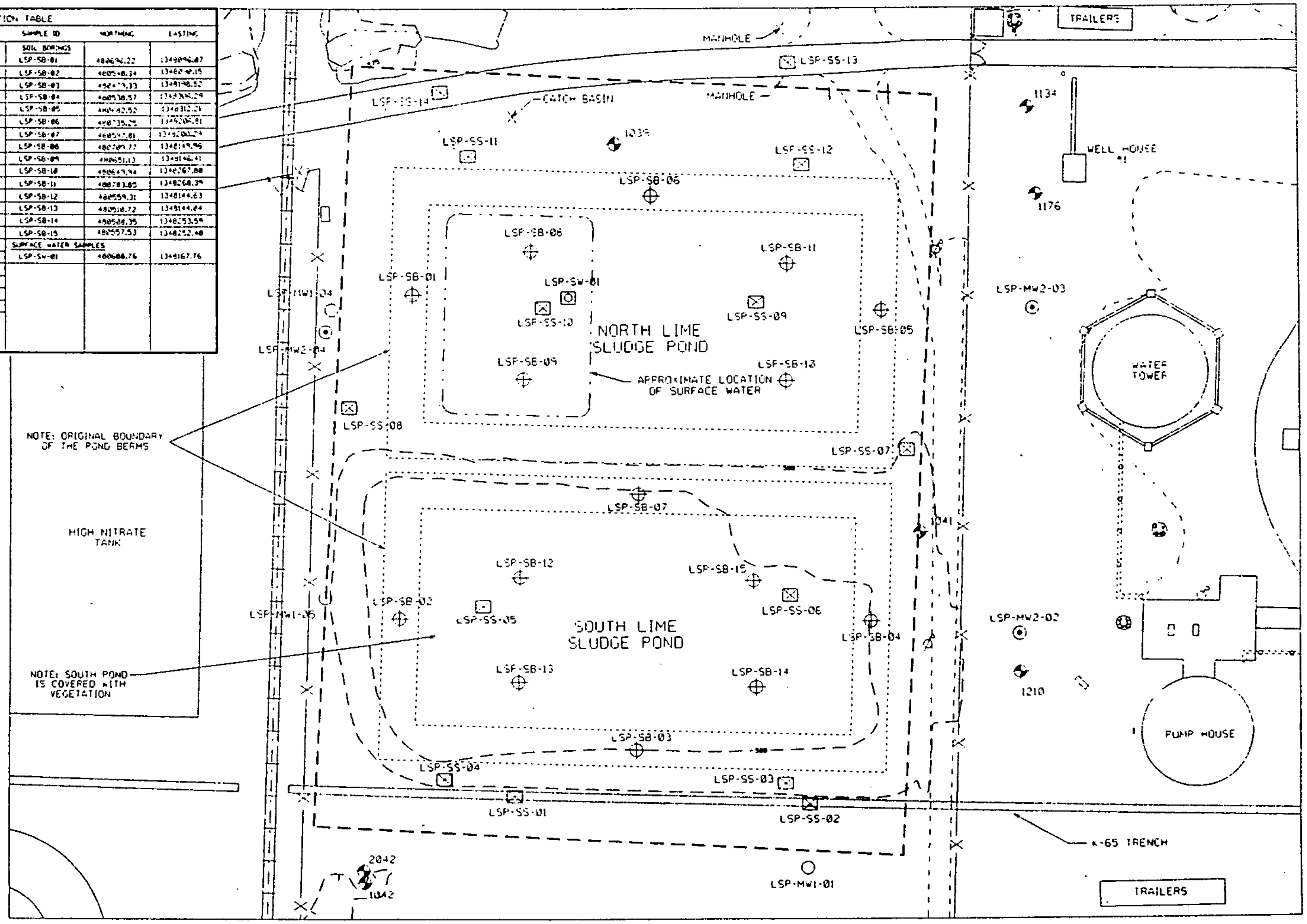
SAMPLE LOCATION TABLE

SAMPLE ID		EASTING	SAMPLE ID	NORTHING	EASTING
MONITORING WELLS			SOIL BORINGS		
LSP-MW1-01	480424.92	1348277.27	LSP-SB-01	480696.22	1348096.07
LSP-MW1-04	480683.12	1348058.77	LSP-SB-02	480548.34	[illegible]
LSP-MW1-05	480544.62	1348055.81	LSP-SB-03	[illegible]	1348198.52
LSP-MW2-02	480532.46	1348375.06	LSP-SB-04	480530.57	1348305.29
LSP-MW2-03	480683.05	1348381.74	LSP-SB-05	480642.52	1348312.21
LSP-MW2-04	[illegible]	[illegible]	LSP-SB-06	480735.25	1348206.91
SURFACE SAMPLES			LSP-SB-07	480547.81	1348200.29
LSP-SS-01	480458.17	1348142.28	LSP-SB-08	480709.72	1348149.95
LSP-SS-02	480454.45	1348278.24	LSP-SB-09	480651.13	1348146.41
LSP-SS-03	480464.01	1348267.06	LSP-SB-10	480643.94	1348267.88
LSP-SS-04	480466.14	1348110.41	LSP-SB-11	480703.05	1348268.39
LSP-SS-05	480554.04	1348127.94	LSP-SB-12	480559.31	1348144.63
LSP-SS-26	480550.62	1348265.21	LSP-SB-13	480510.72	1348144.84
LSP-SS-07	480618.10	1348323.91	LSP-SB-14	480508.35	1348253.59
LSP-SS-08	480635.29	1348066.06	LSP-SB-15	480557.53	1348252.40
LSP-SS-09	[illegible]	[illegible]	SURFACE WATER SAMPLES		
LSP-SS-10	480683.90	1348155.55	LSP-SW-01	480680.76	1348167.76
LSP-SS-11	480753.10	1348121.29			
LSP-SS-12	480748.69	1348275.57			
LSP-SS-13	480795.03	1348269.51			
LSP-SS-14	480781.93	1348108.56			



LEGEND

- FENCE
- RAILROAD
- LIGHT POLE
- TREE LINE
- RIVER, STREAM
- MAJOR CONTOUR
- MINOR CONTOUR
- PAVED ROADWAY
- UNPAVED ROADWAY
- APPROXIMATE SUBUNIT BOUNDARY
- ORIGINAL BOUNDARY OF THE POND BERMS
- EXISTING MONITORING WELL

PROPOSED SAMPLE LOCATIONS

- SOIL BORING
- 1000 SERIES MONITORING WELL
- 2000 SERIES MONITORING WELL
- SURFACE SOIL
- SURFACE WATER
- SEDIMENT

NOTE: 4 ADDITIONAL SOIL SAMPLES WILL BE FROM A TRENCH TO BE EXCAVATED ADJACENT TO THE K-65 TRENCH. SAMPLES WILL BE COLLECTED BASED ON FIELD SCREENING.
ALL SAMPLES ARE APPROXIMATE AND SUBJECT TO ADJUSTMENT IN THE FIELD.
COORDINATES ARE IN NAD 1983 STATE PLANE

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REF. NO.:	DATE:	APPROVED:	DATE:
REF. NO.:	DATE:	APPROVED:	DATE:

DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHY

NOTES: WELL 1229 NOT SHOWN
LSP-MW1-01 WILL BE LOCATED BASED UPON GRADIENT OF TILL GROUNDWATER AND OBSERVERED SOIL CONTAMINATION ADJACENT TO THE K-65 TRENCH.
SURFACE SAMPLES FROM TRENCH TO BE COLLECTED FROM RESIDUE WITHIN TRENCH.
SOIL BORINGS LSP-SB-01 THROUGH LSP-SB-07 ARE SHALLOW BORINGS IN THE BERMS.

DRAFTER:	WILLIAMS
DESIGN FILE:	c110008.dgn
DEPARTMENT:	G.I.S.
DWG. NO.:	c11-0008
DATE:	3-4-93

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FIGURE 8-4
LIME SLUDGE POND PROPOSED SAMPLE LOCATIONS

TABLE 8-4
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE LIME SLUDGE POND

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
GROUNDWATER SAMPLES[1]					
LSP-MW1-01	N/A	B	B	A[2]	
LSP-MW1-04	N/A	B	B	A	
LSP-MW1-05	N/A	B	B	A	
LSP-MW2-02	N/A	B	B	A	
LSP-MW2-03	N/A	B	B	A	
LSP-MW2-04	N/A	B	B	A	
SOIL BORINGS FOR MONITORING WELLS					
LSP-MW1-01	4 - 6			A	UC, [D]
LSP-MW2-02	2 - 4			A	[D], [E]
LSP-MW2-03	4 - 6			A	UC, [D]
LSP-MW1-04	2 - 4			A	[D], [E]
LSP-MW2-04				A	
LSP-MW1-05	4 - 6			A	[D], UC
SURFACE SAMPLES					
LSP-SS-01	N/A	C	C		
LSP-SS-02	N/A	C	C		
LSP-SS-03 - 0	0 - 0.5	C	C		
LSP-SS-03 - 0.5	0.5 - 1.0	C	C		
LSP-SS-04 - 0	0 - 0.5	C	C		
LSP-SS-04 - 0.5	05 - 1.0	C	C		
LSP-SS-05	0 - 0.5	C	C		
LSP-SS-06	0 - 0.5	C	C		
LSP-SS-07 - 0	0 - 0.5	C	C		
LSP-SS-07 - 0.5	0.5 - 1.0	C	C		
LSP-SS-08 - 0	0 - 0.5	C	C		

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
LSP-SS-08 - 0.5	0.5 - 1.0	C	C		
LSP-SS-09	0 - 0.5	C	C		
LSP-SS-10	0 - 0.5	C	C		
LSP-SS-11 - 0	0 - 0.5	C	C		
LSP-SS-11 - 0.5	0.5 - 1.0	C	C		
LSP-SS-12 - 0	0 - 0.5	C	C		
LSP-SS-12 - 0.5	0.5 - 1.0	C	C		
LSP-SS-13	0 - 0.5	C	C		
LSP-SS-14	0 - 0.5	C	C		
<u>SURFACE WATER SAMPLES</u>					
LSP-SW-01	N/A	B	B		

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TABLE 8-4
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE LIME SLUDGE POND

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SOIL BORINGS					
LSP-SB-01 - 0.5	0.5 - 1	C	C	X(3)	
LSP-SB-01 - 1	1 - 3				[D], [E]
LSP-SB-02 - 0.5	0.5 - 1	C	C	X	
LSP-SB-03 - 0.5	0.5 - 1	C	C		
LSP-SB-04 - 0.5	0.5 - 1	C	C	X	
LSP-SB-04 - 1	1 - 3				[D], [E]
LSP-SB-05 - 0.5	0.5 - 1	C	C	X	
LSP-SB-06 - 0.5	0.5 - 1	C	C		
LSP-SB-07 - 0.5	0.5 - 1	C	C		
LSP-SB-07 - 1	1 - 3				[D], [E]
LSP-SB-08 - 2	2 - 2.5	C	C		
LSP-SB-08 - 2.5	2.5 - 5				W, γd, [E], [H]
LSP-SB-08 - 10	10 - 10.5	C	C		
LSP-SB-08 - 10.5	10.5 - 12.5				[D], [E], HC
(Assumes fill at 8' deep)					
LSP-SB-09 - 7	5 - 7	C	C		W, γd, [E], [H]
LSP-SB-09 - 8	8 - 10				[D], [E]
LSP-SB-09 - 10	10 - 10.5	C	C		
(Assumes fill at 8' deep)					
LSP-SB-10 - 2	2 - 2.5	C	C		
LSP-SB-10 - 2.5	2.5 - 5				W, γd, [E], [H]
LSP-SB-10 - 10	10 - 10.5	C	C		
LSP-SB-10 - 10.5	10.5 - 12.5				[D], [E], [F]
(Assumes fill at 8' deep)					

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TABLE 8-4
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE LIME SLUDGE POND

		ANALYTES			
SAMPLE ID	ESTIMATED DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SOIL BORINGS					
LSP-SB-11 - 2	2 - 5				
LSP-SB-11 - 5	5 - 5.5	C	C		W,γd, [E], [H]
LSP-SB-11 - 8	8 - 10				[D], [E]
LSP-SB-11 - 10	10 - 10.5	C	C		
LSP-SB-11 - 13	13 - 13.5	C	C		
(Assumes fill at 8' deep)					
LSP-SB-12 - 2.5	2.5 - 5				W, γd, [E], [H]
LSP-SB-12 - 5	5 - 5.5	C	C		
LSP-SB-12 - 10	10 - 12				[D], [E], [F]
LSP-SB-12 - 12	12 - 12.5'	C	C		
(Assumes fill interface at 10' deep)					
LSP-SB-13 - 2	2 - 2.5	C	C		W, γd, [E], [H]
LSP-SB-13 - 5	5 - 7				[D], [E]
LSP-SB-13 - 10	10 - 12				
LSP-SB-13 - 12	12 - 12.5	C	C		
(Assumes fill interface at 10' deep)					
LSP-SB-14 - 2.5	2.5 - 5				W, γd, [E], [H]
LSP-SB-14 - 5	5 - 5.5	C	C		
LSP-SB-14 - 12	12 - 12.5	C	C		
LSP-SB-14 - 12.5	12.5 - 15				[D], [E], [F]
(Assumes fill at 10' deep)					
LSP-SB-15 - 2	2 - 2.5	C	C		W, γd, [E], [H]
LSP-SB-15 - 4	4 - 6				[D], [E]
LSP-SB-15 - 10	10 - 12				
LSP-SB-15 - 12	12 - 12.5	C	C		

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LSP-SB-15 - 12	12 - 12.5	C	C		
LSP-SB-15 - 15	15 - 15.5	C	C		
(Assumes fill interface at 10' deep)					

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NOTES

(1) Existing monitor wells will also be sampled. These include wells 1039, 1041, 1042, 1134, 1176, 1210, 1229, 2042.

Screening rad on water samples by laser phosphorimeter.

(3) Screening rad on soil samples by X-ray fluorescence.

TARGET ANALYTE LISTS 20.03.05 A Through I:

[A] Water/Soil - total Uranium

[B] Groundwater/Surface Water - Full HSL, Full Rad., Misc. Rad., Gen Groundwater Quality

[C] Soil/Sediment/Sludge/Waste - Full HSL, Full Rad., Misc. Rad.

[D] Classification Tests

SG = Specific Gravity
W = Water Content
γd = dry unit weight
LL = liquid limit
PL = plastic limit
Grain Size
SA = sieve analysis
HA = hydrometer analysis

-] Con = Consolidation test

[F] HC = Hydraulic Conductivity

Strength Tests

[G] UC = Unconfined Compression
CIU = Consolidated Isotropic Undrained
DS = Direct Shear

[H] TCLP (Toxicity List)

[I] TCLP plus Cu, Fe, Mn, Zn

TABLE 8-5
ACTIVE FLYASH PILE
PROPOSED SAMPLING SUMMARY[1]

Source of Sample	Number of Locations	Location/ Description	Sample Media	No.of Samples per Location	No. of Samples[2]	Sample Interval	Sample Parameters
SURFACE	6	Surface of Flyash Pile	Flyash	1	6	0-6 in.	Full HSL and rad.
SURFACE WATER/ SEDIMENT	2 6	Around base of Pile	SW[3] Sediment	1 1	8	NA[4]	Full HSL and rad.
BORINGS	3	40-45 ft	Flyash/ Soil	5	15	- 0-6 in. -2 ft deep -middle -fill/soil interface -5 ft under fill	Full HSL and rad.
MONITORING WELLS (new/exist.)	6	1000-Series 2000-Series	GW[5]	1	0/2 1/3	NA	Full HSL and rad.

(1) Routine field and on-site screening samples not included
(2) QC samples not included
(3) surface water
(4) not applicable
(5) groundwater

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AND SUBJECT TO ADJUSTMENT IN THE FIELD

SAMPLE LOCATION TABLE		
SAMPLE ID	NORTHING	EASTING
MONITORING WELLS		
AFP-MW2-01	47732.81	1348729.70
SURFACE SAMPLES		
AFP-SS-01	477251.96	1348341.16
AFP-SS-02	477229.95	1348473.97
AFP-SS-03	477265.40	1348609.79
AFP-SS-04	477312.86	1348636.13
AFP-SS-05	477384.73	1348571.91
AFP-SS-06	477350.83	1348368.24
SEDIMENT SAMPLES		
AFP-SD-01	477204.08	1348281.83
AFP-SD-02	477170.36	1348501.23
AFP-SD-03	4772244.32	1348641.68
AFP-SD-04	477353.66	1348669.64
AFP-SD-05	477414.67	1348588.29
AFP-SD-06	477457.30	1348482.64
SURFACE WATER SAMPLES		
AFP-SW-01	477217.43	1348269.59
AFP-SW-02	477462.69	1348461.90
SOIL BORINGS		
AFP-SB-01	477270.90	1348424.39
AFP-SB-02	477309.74	1348520.82
AFP-SB-03	477395.53	1348495.36

LEGEND

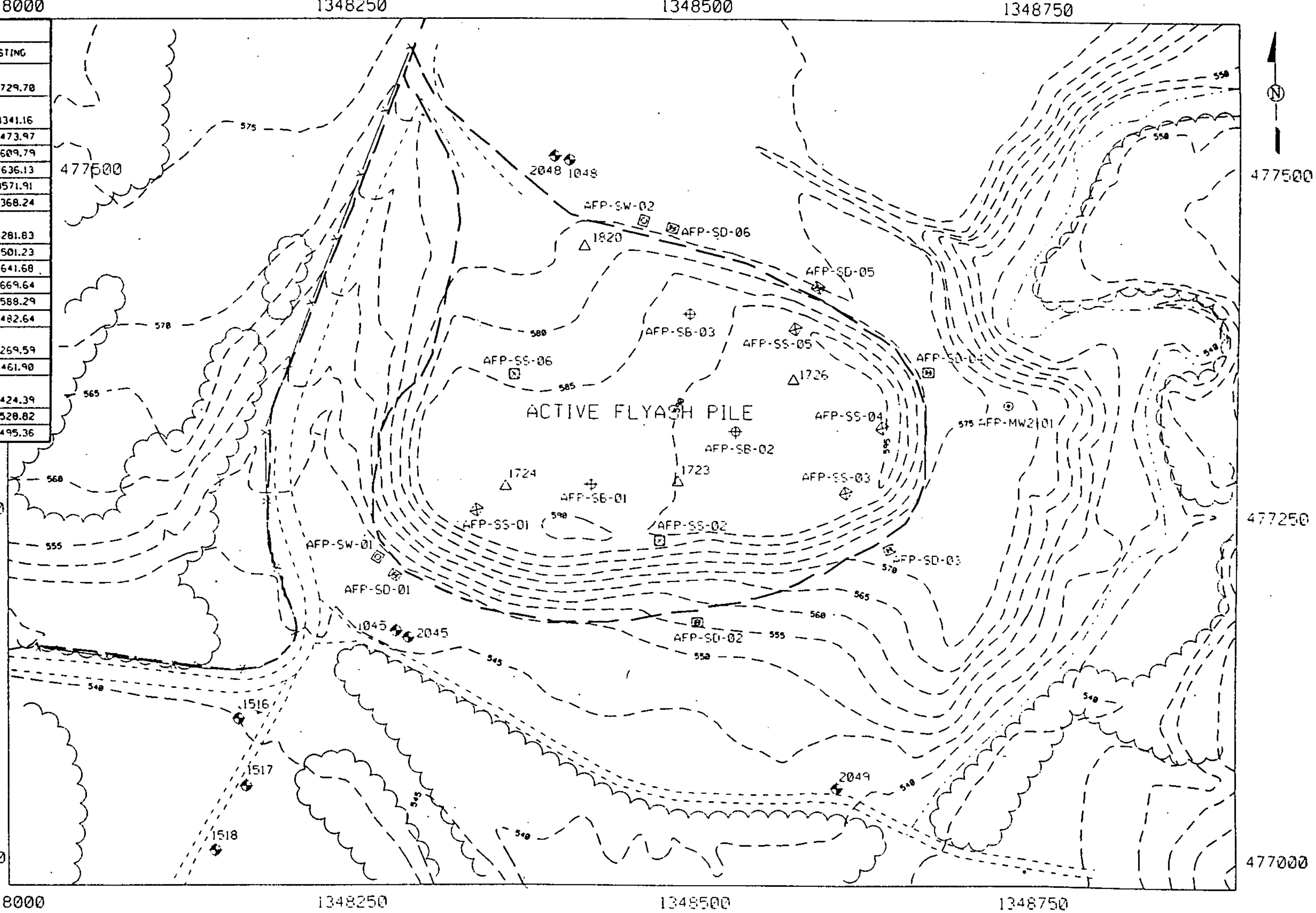
- LIMITS OF RADIOLOGICAL CONTROLLED AREA
- RAILROAD
- LIGHT POLE
- TREE LINE
- RIVER, STREAM
- MAJOR CONTOUR
- MINOR CONTOUR
- PAVED ROADWAY
- UNPAVED ROADWAY
- APPROXIMATE SUBUNIT BOUNDARY
- 2134 EXISTING MONITORING WELL
- EXISTING BORING

PROPOSED SAMPLE LOCATIONS

- 1000 SERIES MONITORING WELL
- 2000 SERIES MONITORING WELL
- SURFACE SOIL
- SOIL BORING
- SURFACE WATER
- SEDIMENT SAMPLE

37.5 0 37.5 75

SCALE IN FEET



REF. NO.:	DATE:	APPROVED:	DATE:
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REF. NO.:	DATE:	APPROVED:	DATE:

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NOTES: Surface Water Samples to be collected on an as-possible basis adjustments may occur in field for sediment or surface water samples based on the locations of drainages.
COORDINATES ARE IN NAD 1983 STATE PLANE

DRAFTER:	WILLIAMS
DESIGN FILE:	d110007.dgn
DEPARTMENT:	G.I.S.
DWG. NO.:	D11-0007
DATE:	3-8-93

REV 1

FIGURE 8-5

ACTIVE FLYASH PILE PROPOSED SAMPLE LOCATIONS

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TABLE 8-6
LIST OF NEW SAMPLES & ANALYTES[1]
PROPOSED FOR THE ACTIVE FLYASH PILE

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
GROUNDWATER SAMPLES [1]					
AFP-MW2-01	N/A	B	B	A	
SURFACE SAMPLES					
AFP-SS-01	0 - 0.5	C	C		
AFP-SS-02	0 - 0.5	C	C		
AFP-SS-03	0 - 0.5	C	C		
AFP-SS-04	0 - 0.5	C	C		
AFP-SS-05	0 - 0.5	C	C		
AFP-SS-06	0 - 0.5	C	C		
SEDIMENT SAMPLES					
AFP-SD-01	0 - 0.5	C	C	A	
AFP-SD-02	0 - 0.5	C	C	A	
AFP-SD-03	0 - 0.5	C	C	A	
AFP-SD-04	0 - 0.5	C	C	A	
AFP-SD-05	0 - 0.5	C	C	A	
AFP-SD-06	0 - 0.5	C	C	A	
SURFACE WATER SAMPLES					
AFP-SW-01	0 - 0.5	B	B	A[2]	
AFP-SW-02	0 - 0.5	B	B	A	
SOIL BORINGS					
AFP-SB-01 - 0.5	0 - 0.5	C	C		
AFP-SB-01 - 2	2 - 4	C	C		[I]
AFP-SB-01 - 6	6 - 8	C	C		γd, W, SA, DS
AFP-SB-01 - 20	20 - 20.5				
AFP-SB-01 - 30	30 - 32				γd, W, SA, CIU
AFP-SB-01 - 40	40 - 40.5	C	C		

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		ANALYTES			
SAMPLE ID	ESTIMATED DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
AFP-SB-01 - 42	42 - 44				[D]
AFP-SB-01 - 45	45 - 45.5	C	C		
(Assumes total depth of flyash is 40')					

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TABLE 8-6
LIST OF NEW SAMPLES & ANALYTES[1]
PROPOSED FOR THE ACTIVE FLYASH PILE

		ANALYTES			
SAMPLE ID	ESTIMATED DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SOIL BORINGS					
AFP-SB-02 - 0.5	0 - 0.5	C	C		
AFP-SB-02 - 2	2 - 4	C	C		[I]
AFP-SB-02 - 13.5	13.5 - 15	C	C		γd, W, SA, DS
AFP-SB-02 - 15	15.5 - 17.5				[I]
AFP-SB-02 - 30	30 - 30.5	C	C		
AFP-SB-02-32	32 - 35				[D]
AFP-SB-02 - 35	35 - 35.5	C	C		
(Assumes total depth of flyash is 30')					
AFP-SB-03 - 0.5	0 - 0.5	C	C		
AFP-SB-03 - 2	2 - 2.5	C	C		
AFP-SB-03 - 10	8.5 - 10.5	C	C		[6]
AFP-SB-03 - 18	18 - 20				γd, W, SA, CIU
AFP-SB-03 - 20	20 - 20.5	C	C		
AFP-SB-03 - 25	25 - 25.5	C	C		
(Assumes total depth of flyash is 20' deep)					

NOTES

(1) Existing monitor wells will also be sampled. These include wells 1045, 1048, 2045, 2048, 2049.

Screening rad on water samples by laser phosphorimeter.

(3) Spring samples to be sent for on-site screening per the SAP.

(4) Screening rad on soil samples by

TARGET ANALYTE LIST 20.03.05 A Through I:

[A] Water/Soil - total Uranium

[B] Groundwater/Surface Water - Full HSL, Full Rad., Misc. Rad., Gen Groundwater Quality

[C] Soil/Sediment/Sludge/Waste - Full HSL, Full Rad., Misc. Rad.

[D] Classification Tests

SG = Specific Gravity
W = Water Content
γd = dry unit weight
LL = liquid limit
PL = plastic limit
Grain Size
SA = shear analysis
HA = hydrometer analysis

[E] Con = Consolidation test

[F] HC = Hydraulic Conductivity

Strength Tests

[G] UC = Unconfined Compression
CIU = Consolidated Isotropic Undrained
DS = Direct Shear

[H] TCLP (Toxicity List)

[I] TCLP plus Cu, Fe, Mn, Zn

TABLE 8-7
INACTIVE FLYASH PILE
PROPOSED SAMPLING SUMMARY[1]

Source of Sample	Number of Locations	Location/ Description	Sample Media	No. of Samples per Location	No. of Samples[2]	Sample Interval	Sample Parameters
SURFACE	7	Ash Pile	Soil Cover	1	7	0-6 in.	Full HSL and rad.
SURFACE WATER/ SEDIMENT	4	NA[3]	Sed. SW[4]	1 1	4 4	0-6 in. NA	Full HSL and rad.
BORINGS	5	25 to 40 ft.	Soil/ Waste	4	20	-6-12 in. -Ash-Variable -Fill-Variable -5 ft. below fill	Full HSL and rad. TCLP for Ash Only
MONITORING WELLS (new/exist)	8	1000-Series 2000-Series	GW[5] GW	1 1	1/3 1/3	NA NA	Full HSL and rad.

(1) Routine field and on-site screening samples not included
(2) QC samples not included
(3) not applicable
(4) surface water
(5) groundwater

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SAMPLE ID	NORTHING	EASTING
2000 SERIES MONITORING WELL		
IFP-MW2-01	478145.96	1347490.99
1000 SERIES MONITORING WELL		
IFP-MW1-02	477700.09	1347683.00
SOIL BORINGS		
IFP-SB-01	477769.03	1347752.03
IFP-SB-02	477779.22	1347981.71
IFP-SB-03	477848.60	1347646.50
IFP-SB-04	477936.66	1347583.02
IFP-SB-05	478120.95	1347563.19
SURFACE SOIL SAMPLES		
IFP-SS-01	477729.59	1347819.24
IFP-SS-02	477809.73	1347640.10
IFP-SS-03	477841.69	1347576.91
IFP-SS-04	477868.41	1347488.96
IFP-SS-05	478018.49	1347561.93
IFP-SS-06	478089.35	1347457.70
IFP-SS-07	478195.25	1347554.11
SURFACE WATER SAMPLES		
IFP-SW-01	477776.50	1347453.70
IFP-SW-02	478198.50	1347443.03
IFP-SW-03	477982.01	1347305.20
IFP-SW-04	477648.42	1347321.21
SEDIMENT SAMPLES		
IFP-SD-01	477766.74	1347464.06
IFP-SD-02	478182.56	1347440.76
IFP-SD-03	477974.05	1347315.42
IFP-SD-04	477636.49	1347321.21

NOTE: ALL SAMPLES LOCATIONS ARE APPROXIMATE AND SUBJECT TO ADJUSTMENT IN THE FIELD

LEGEND

- LIMITS OF RADIOLOGICAL CONTROLLED AREA
- LIMITS OF RADIOLOGICAL REGULATED AREA
- RAILROAD
- LIGHT POLE
- TREE LINE
- RIVER, STREAM
- MAJOR CONTOUR
- MINOR CONTOUR
- PAVED ROADWAY
- UNPAVED ROADWAY
- APPROXIMATE SUBUNIT BOUNDARY
- LIMIT OF TILL(INFERRED)
- EXISTING MONITORING WELL

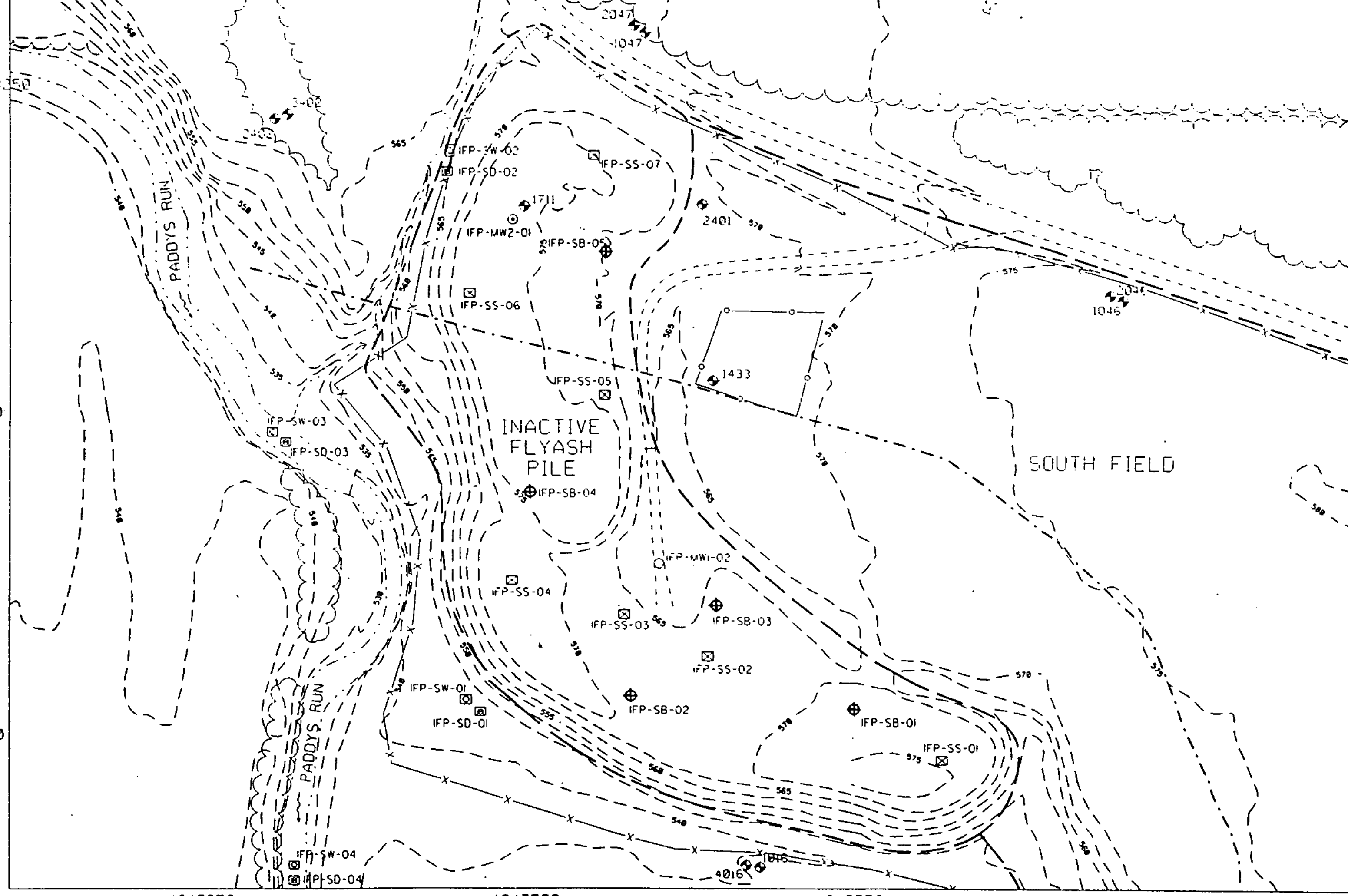
PROPOSED SAMPLE LOCATIONS

- 1000 SERIES MONITORING WELL
- 2000 SERIES MONITORING WELL
- SOIL BORING
- SURFACE SOIL
- SURFACE WATER
- SEDIMENT SAMPLE

NOTE : ADDITIONAL REGULATED AREAS TOO SMALL TO BE SHOWN

40 0 40 80

SCALE IN FEET



REF. NO.:	DATE:	APPROVED:	DATE:	NOTES:
REF. NO.:	DATE:	APPROVED:	DATE:	COORDINATES ARE IN STATE PLANE NAD 1983
REF. NO.:	DATE:	APPROVED:	DATE:	

DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHY

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FERMCO
RESTORATION MANAGEMENT CORPORATION

DRAFTER:	HOEFLICH
DESIGN FILE:	d110010.dgn
DEPARTMENT:	G.I.S.
DWG. NO.:	d11-0010
DATE:	3-8-93

REV 1

FIGURE 8-6

INACTIVE FLYASH PILE PROPOSED SAMPLE LOCATIONS

8 7 6 5 4 3 2 1

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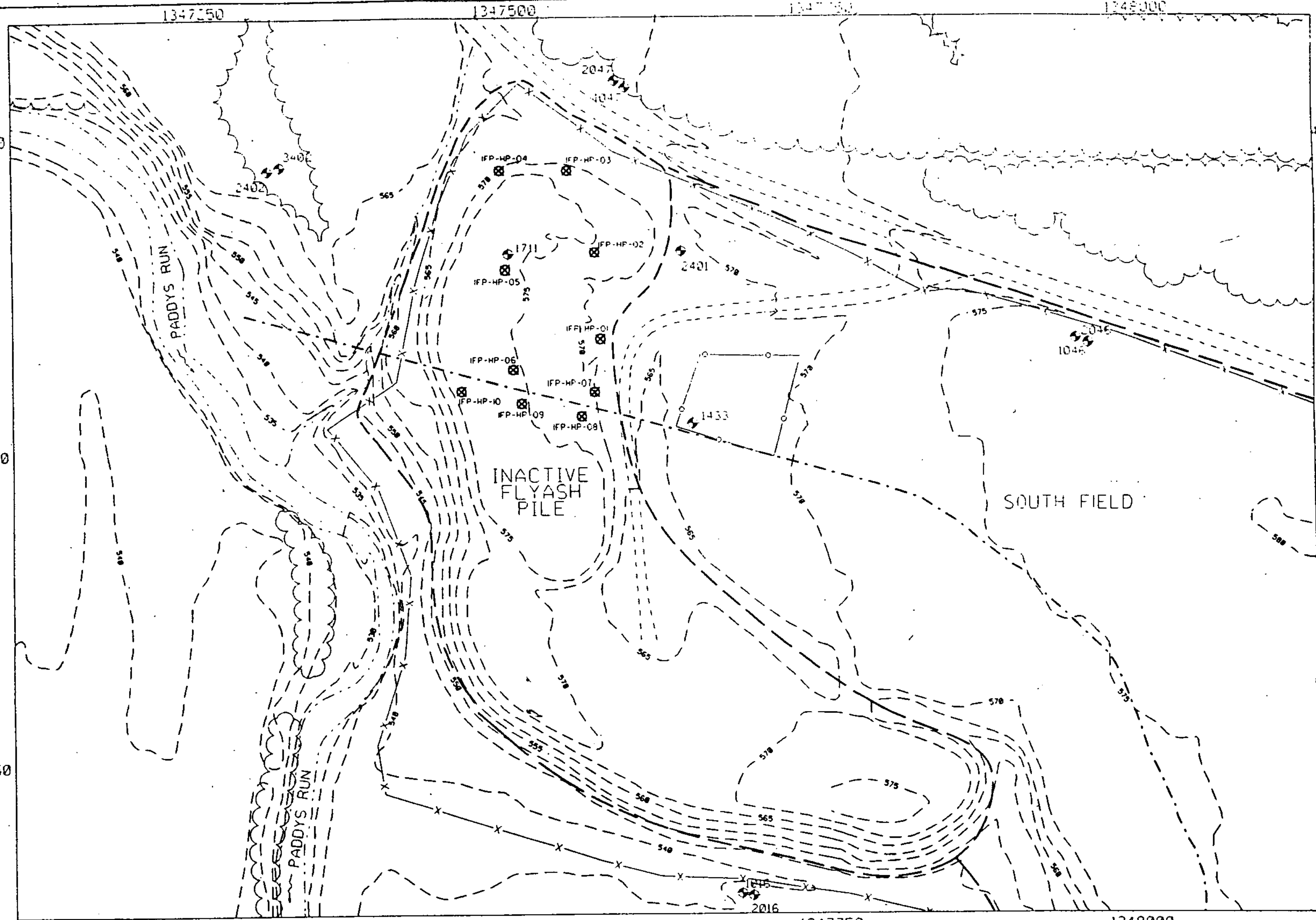

SAMPLE ID	NORTHING	EASTING
HYDROPUNCH/BORINGS		
IFP-HP-01	478,085.62	1,347,572.01
IFP-HP-02	478,156.56	1,347,568.8
IFP-HP-03	[illegible]	1,347,546.[illegible]
IFP-HP-04	[illegible]	1,347,493.06
IFP-HP-05	478,143.57	1,347,437.46
IFP-HP-06	478,064.96	1,347,502.85
IFP-HP-07	478,046.17	1,347,567.04
IFP-HP-08	478,027.99	1,347,556.37
IFP-HP-09	478,037.07	1,347,509.93
IFP-HP-10	[illegible]	[illegible]

NOTE: ALL SAMPLES LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE IN THE FIELD.

LEGEND

- LIMITS OF RADIOLOGICAL CONTROLLED AREA
- LIMITS OF RADIOLOGICAL REGULATED AREA
- RAILROAD
- LIGHT POLE
- TREE LINE
- RIVER, STREAM
- MAJOR CONTOUR
- MINOR CONTOUR
- PAVED ROADWAY
- UNPAVED ROADWAY
- APPROXIMATE SUB-UNIT BOUNDARY
- LIMITS OF TILL (INFERRED)
- EXISTING MONITORING WELL

PROPOSED SAMPLE LOCATIONS

- HYDROPUNCH SAMPLES AND ID NUMBER

NOTE: ADDITIONAL REGULATED AREAS TOO SMALL TO BE SHOWN

41.25 0 41.25 82.5

SCALE IN FEET

FERMCO RESTORATION MANAGEMENT CORPORATION

REF. NO.: DATE:	APPROVED: DATE:	
REF. NO.: DATE:	APPROVED: DATE:	
REF. NO.: DATE:	APPROVED: DATE:	

DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHY

NOTES:

ADDITIONAL SAMPLE LOCATIONS TO BE FIELD LOCATED & LATER SURVEYED BASED ON FIELD DATA.

COORDINATES ARE IN STATE PLANE, NAD 1983.

DRAFTER:	HOEFLICH
DESIGN FILE:	C110009.dgn
DEPARTMENT:	G.I.S.
DWG. NO.:	c11-0009
DATE:	3-4-93

REV 1

FIGURE 8-7

INACTIVE FLYASH PILE PROPOSED HYDROPUNCH SAMPLE LOCATIONS

8 7 6 5 4 3 2 1

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TABLE 8-8
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE INACTIVE FLYASH PILE

		ANALYTES			
SAMPLE ID	ESTIMATED DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
GROUNDWATER SAMPLES[1]					
IFP-MW2-01	N/A	B	B	A	
IFP-MW1-02	N/A	B	B	A	
SOIL BORINGS FOR MONITORING WELLS					
IFP-MW2-01				A[4]	
IFP-MW1-02				A	
SOIL BORINGS[5]					
IFP-SB-01 (Assumes Native Soil at Depth of 12')	.5 - 2 4 - 6 12 - 14 19 - 21	C C C C	C C C C	A A A A	[D] [H], γd, SA [D]
IFP-SB-02 (Assumes Fill at Depth of 18')	.5 - 2 10 - 12 18 - 20 26 - 28	C C C C	C C C C	A A A A	[D] [H], γd, SA [D] [D], [F]
IFP-SB-03 (Assumes Fill at Depth of 18')	.5 - 2 4 - 6 18 - 20 25 - 28	C C C C	C C C C	A A A A	[D] [H], γd, SA [D] [D]
IFP-SB-04 (Assumes Soil at Depth of 10')	.5 - 2 6 - 8 10 - 12 15 - 17	C C C C	C C C C	A A A A	[D] [H], γd, SA [D]
IFP-SB-05 (Assumes Fill at Depth of 16')	.5 - 2 10 - 12 16 - 18 25 - 27	C C C C	C C C C	A A A A	[D] [H], γd, SA [D], [F]
SURFACE SOIL SAMPLES					
IFP-SS-01	0 - 0.5	C	C		
IFP-SS-02	0 - 0.5	C	C		
IFP-SS-03	0 - 0.5	C	C		
IFP-SS-04	0 - 0.5	C	C		
IFP-SS-05	0 - 0.5	C	C		

SAMPLE ID	ESTIMATED DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
IFP-SS-06	0 - 0.5	C	C		
IFP-SS-07	0 - 0.5	C	C		

TABLE 8-8
LIST OF NEW SAMPLES & ANALYTES
PROPOSED FOR THE INACTIVE FLYASH PILE

		ANALYTES			
SAMPLE ID	ESTIMATED DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SEDIMENT SAMPLES					
IFP-SD-01	0 - 0.5	C	C		
IFP-SD-02	0 - 0.5	C	C		
IFP-SD-03	0 - 0.5	C	C		
IFP-SD-04	0 - 0.5	C	C		
SURFACE WATER SAMPLES					
IFP-SW-01(3)		B	B	A(2)	
IFP-SW-02		B	B	A	
IFP-SW-03		B	B	A	
IFP-SW-04		B	B	A	
HYDROPUNCH(6)					
IF-HP-01				A(7)	
IF-HP-02				A	
IF-HP-03				A	
IF-HP-04				A	
IF-HP-05				A	
IF-HP-06				A	
IF-HP-07				A	
IF-HP-08				A	
IF-HP-09				A	
IF-HP-10				A	

NOTES

(1) Existing monitor wells will also be sampled. These include 1047, 1711, 2047, 1016, 2016, 2402, 2401.

Screening rad on water samples by laser phosphorimetry.

(3) Spring samples if collected in drainage, to be sent for on-site screening per the SAP.

(4) Screening rad on soil samples by X-ray fluorescence.

(5) RCRA/Geotechnical will be conducted on samples at the same depth at which an HSL sample is collected within the Flyash layer.

(6) Hydropunch sampling will generate soils samples that will be field screened. Soil samples may be selected for on-site laboratory screening.

(7) Hydropunch water screening for total uranium by laser phosphorescence.

TARGET ANALYTE LIST 20.03.05 A Through I:

[A] Water/Soil - total Uranium

[B] Groundwater/Surface Water - Full HSL, Full Rad., Misc. Rad., Gen Groundwater Quality

[C] Soil/Sediment/Sludge/Waste - Full HSL, Full Rad., Misc. Rad.

[D] Classification Tests

SG = Specific Gravity
W = Water Content
γd = dry unit weight
LL = liquid limit
PL = plastic limit
Grain Size
SA = Sieve Analysis
HA = Hydrometer Analysis

[E] Con = Consolidation test

[F] HC = Hydraulic Conductivity

Strength Tests

[G] UC = Unconfined Compression
CIU = Consolidated Isotropically Undrained
DS = Direct Shear

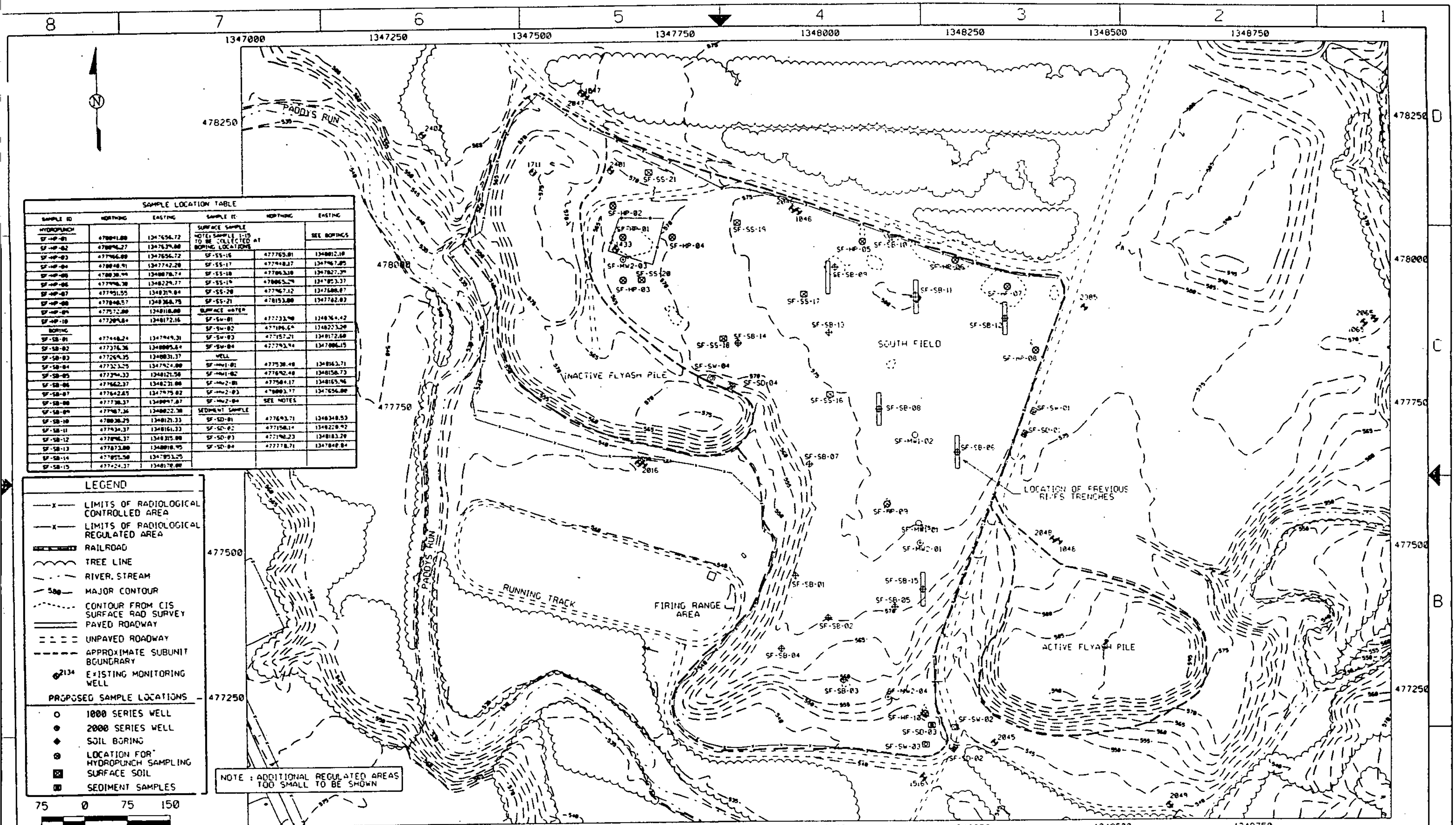
[H] TCLP (Toxicity List)

[I] TCLP plus Cu, Fe, Mn, Zn

TABLE 8-9
SOUTH FIELD
PROPOSED SAMPLING SUMMARY[1]

Source of Sample	Number of Locations	Location/ Description	Sample Media	No. of Samples per Location	No. of Samples[2]	Sample Interval	Sample Parameters
SURFACE	21 10	hot spots, anomalies below highest surface	soil soil	1 1	21 10	0-6 in. 6-12 in.	Full HSL and rad.
SURFACE WATER/ SEDIMENT	4 4	drainage along SE perimeter	SW[3] Sediment	1 1	4 4	N/A[4]	Full HSL and rad.
BORINGS	15 5 10[5]	15 feet depth 40 feet depth near Wells 1433/1711	soil soil soil	2 2 1	30 10 10	-1 sample from fill -one sample from native soil -screening based	Full HSL and rad.
TRENCH	5 10	surface wipes highest screen	debris soil	1 1	5 10	0 in. 0-5 in.	Full HSL and rad.
MONIT. WELLS (new/exist)	17	1000-series 2000-series	GW[6]	1 1	2/7 3/5	N/A	Full HSL and rad.

(1) Routine field and on-site screening samples not included
(2) QC samples not included
(3) surface water
(4) not applicable
(5) borings for HYDROPUNCH groundwater sampling
(6) groundwater



SAMPLE LOCATION TABLE					
SAMPLE ID	NORTHING	EASTING	SAMPLE ID	NORTHING	EASTING
HYDROPUNCH			SURFACE SAMPLE		
SF-HP-01	478041.00	1347656.72	NOTE: SAMPLE 1-15 TO BE COLLECTED AT BORING LOCATIONS		SEE BORINGS
SF-HP-02	478096.27	1347639.00			
SF-HP-03	477966.00	1347656.72	SF-SS-16	477765.01	1348012.10
SF-HP-04	478040.91	1347742.20	SF-SS-17	477948.17	1347967.85
SF-HP-05	478030.99	1348078.74	SF-SS-18	477863.10	1347827.39
SF-HP-06	477998.30	1348229.77	SF-SS-19	478065.29	1347853.37
SF-HP-07	477951.55	1348319.04	SF-SS-20	477967.12	1347680.07
SF-HP-08	477840.57	1348368.75	SF-SS-21	478153.00	1347782.03
SF-HP-09	477572.00	1348118.00	SURFACE WATER		
SF-HP-10	477209.84	1348172.16	SF-SW-01	477733.90	1348364.42
BORING			SF-SW-02	477106.69	1348223.29
SF-SB-01	477448.24	1347949.31	SF-SW-03	477157.21	1348172.60
SF-SB-02	477376.36	1348005.64	SF-SW-04	477793.94	1347806.15
SF-SB-03	477269.35	1348031.37	WELL		
SF-SB-04	477323.25	1347924.00	SF-MW1-01	477538.40	1348163.71
SF-SB-05	477394.33	1348121.50	SF-MW1-02	477692.40	1348158.73
SF-SB-06	477662.37	1348231.00	SF-MW2-01	477504.17	1348165.96
SF-SB-07	477642.85	1347975.02	SF-MW2-03	478003.77	1347656.00
SF-SB-08	477738.37	1348097.87	SF-MW2-04	SEE NOTES	
SF-SB-09	477987.36	1348022.30	SEDIMENT SAMPLE		
SF-SB-10	478030.29	1348121.33	SF-SD-01	477693.71	1348340.53
SF-SB-11	477934.37	1348161.33	SF-SD-02	477150.14	1348220.92
SF-SB-12	477896.37	1348305.00	SF-SD-03	477198.23	1348183.29
SF-SB-13	477873.00	1348010.95	SF-SD-04	477770.71	1347848.84
SF-SB-14	477855.50	1347853.25			
SF-SB-15	477424.37	1348170.00			

LEGEND

- LIMITS OF RADIOLOGICAL CONTROLLED AREA
- LIMITS OF RADIOLOGICAL REGULATED AREA
- RAILROAD
- TREE LINE
- RIVER, STREAM
- 580 MAJOR CONTOUR
- CONTOUR FROM CIS SURFACE RAD SURVEY
- PAVED ROADWAY
- UNPAVED ROADWAY
- APPROXIMATE SUBUNIT BOUNDARY
- 2134 EXISTING MONITORING WELL

PROPOSED SAMPLE LOCATIONS

- 1000 SERIES WELL
- 2000 SERIES WELL
- SOIL BORING
- LOCATION FOR HYDROPUNCH SAMPLING
- SURFACE SOIL
- SEDIMENT SAMPLES

75 0 75 150
SCALE IN FEET

FERMCO RESTORATION MANAGEMENT CORPORATION

REF. NO.: DATE: APPROVED: DATE:
REF. NO.: DATE: APPROVED: DATE:
REF. NO.: DATE: APPROVED: DATE:

DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHY

NOTES:
WELL SF-MW2-4 WILL BE LOCATED BASED UPON HYDROPUNCH DATA AND SOIL DATA
COORDINATES ARE IN NAD 1983 STATE PLANE. ALL SAMPLES LOCATIONS ARE APPROXIMATE AND SUBJECT TO ADJUSTMENT IN THE FIELD.

DRAFTER: WILLIAMS
DESIGN FILE: d110012.dgn
DEPARTMENT: G.I.S.
DWG. NO.: d11-0012
DATE: 3-8-93

REV 1

FIGURE 8-8
SOUTH FIELD
PROPOSED SAMPLE LOCATIONS

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TABLE 8-10
LIST OF SAMPLES & ANALYTES PROPOSED FOR THE SOUTH FIELD

SAMPLE ID	DEPTH (FT.)	ANALYTES			
		FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SURFACE WATER					
SF-SW-01	N/A	B	B	A	
SF-SW-02	N/A	B	B	A	
SF-SW-03	N/A	B	B	A	
SF-SW-04	N/A	B	B	A	
SEDIMENT					
SF-SD-01	0 - 0.5	C	C	A	
SF-SD-02	0 - 0.5	C	C	A	
SF-SD-03	0 - 0.5	C	C	A	
SF-SD-04	0 - 0.5	C	C	A	
SOIL BORINGS FOR MONITOR WELLS					
SF-MW1-01				A	
SF-MW1-02				A	
SF-MW2-01				A	
SF-MW2-04				A	
SF-MW2-03	5 - 7			A	[D]
SF-MW2-03	25 - 27			A	[D]
HYDRO-PUNCH(1)					
SF-HP-01				A(2)	
SF-HP-02				A	
SF-HP-03				A	
SF-HP-04				A	
SF-HP-05				A	
SF-HP-05				A	
SF-HP-06				A	
SF-HP-07				A	
SF-HP-08				A	

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SAMPLE ID	DEPTH (FT.)	ANALYTES FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SF-HP-09				A	
SF-HP-010				A	

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TABLE 8-10
LIST OF SAMPLES & ANALYTES PROPOSED FOR THE SOUTH FIELD

SAMPLE ID	DEPTH (FT.)	ANALYTES FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
GROUNDWATER SAMPLES[4]					
SF-MW1-01		B	B	A	
SF-MW1-02		B	B	A	
SF-MW2-01		B	B	A	
SF-MW2-03		B	B	A	
SF-MW2-04		B	B	A	
BORING					
SF-SB-01 - 03 SF-SB-01 - 05	3 - 5 5 - 5.5	C	C		[D]
SF-SB-01 - 20 SF-SB-01 - 30	20 - 22 30 - 30.5	C	C		[D]
SF-SB-02 - 2.5 SF-SB-02 - 05	2.5 - 4.5 5 - 5.5	C	C		[D], [E]
SF-SB-02 - 25 SF-SB-02 - 35	25 - 27 35 - 35.5	C	C		[D], [F]
SF-SB-03 - 2.5 SF-SB-03 - 05	2.5 - 4.5 5 - 5.5	C	C		[D]
SF-SB-03 - 15 SF-SB-03 - 45	15 - 17 45 - 45.5	C	C		[D]
SF-SB-04 - 05	5 - 5.5	C	C		
SF-SB-04 - 30	30 - 30.5	C	C		
SF-SB-05 - 03 SF-SB-05 - 05	3 - 5 5 - 5.5	C	C		PL, LL γd
SF-SB-05 - 20	20 - 20.5	C	C		
SF-SB-06 - 2 SF-SB-06 - 5	2 - 4 5 - 5.5	C	C		[D]
SF-SB-06 - 7 SF-SB-06 - 10	7 - 9 10 - 10.5	C	C		[D]
SF-SB-06 - 2 SF-SB-07 - 5	2 - 4 5 - 5.5	C	C		[D], [E]

		ANALYTES			
SAMPLE ID	DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SF-SB-06 - 7 SF-SB-07 - 10	7 - 9 10 - 10.5	C	C		[D], [F]

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TABLE 8-10
LIST OF SAMPLES & ANALYTES
PROPOSED FOR THE SOUTH FIELD

SAMPLE ID	DEPTH (FT.)	ANALYTES: FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SF-SB-08 - 5	5 - 5.5	C	C		[D], [E]
SF-SB-08 - 10	10 - 10.5	C	C		
SF-SB-09 - 3	3 - 3.5	C	C		
SF-SB-09 - 8	8 - 8.5	C	C		
SF-SB-10 - 5	5 - 5.5	C	C		
SF-SB-10 - 10	10 - 10.5	C	C		
SF-SB-11 - 2	2 - 4				[D]
SF-SB-11 - 4	4 - 4.5	C	C		
SF-SB-11 - 9	9 - 9.5	C	C		
SF-SB-12 - 2	2 - 4				[D]
SF-SB-12 - 4	4 - 4.5	C	C		
SF-SB-12 - 9	9 - 9.5	C	C		
SF-SB-13 - 5	5 - 5.9	C	C		
SF-SB-13 - 10	10 - 10.5	C	C		
SF-SB-14 - 4	4 - 6				[D], [E]
SF-SB-14 - 8	8 - 8.5	C	C		
SF-SB-14 - 13	13 - 15				[D], [F]
SF-SB-14 - 15	15 - 15.5	C	C		
SF-SB-15 - 10	10 - 10.5	C	C		
SF-SB-15 - 15	15 - 15.5	C	C		

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TABLE 8-10
LIST OF SAMPLES & ANALYTES
PROPOSED FOR THE SOUTH FIELD

		ANALYTES			
SAMPLE ID	DEPTH (FT.)	FULL RAD	FEMP HSL	SCREENING RAD	RCRA/ GEOTECHNICAL
SURFACE SAMPLES					
SF-SS-01	0 - 0.5	C	C		
SF-SS-02	0 - 0.5	C	C		
SF-SS-03	0 - 0.5	C	C		
SF-SS-04	0 - 0.5	C	C		
SF-SS-05	0 - 0.5	C	C		
SF-SS-06	0 - 0.5	C	C		
SF-SS-07	0 - 0.5	C	C		
SF-SS-08	0 - 0.5	C	C		
SF-SS-09	0 - 0.5	C	C		
SF-SS-10	0 - 0.5	C	C		
SF-SS-11	0 - 0.5	C	C		
SF-SS-12	0 - 0.5	C	C		
SF-SS-13	0 - 0.5	C	C		
SF-SS-14	0 - 0.5	C	C		
SF-SS-15	0 - 0.5	C	C		
SF-SS-16	0 - 0.5	C	C		
SF-SS-17	0 - 0.5	C	C		
SF-SS-18	0 - 0.5	C	C		
SF-SS-19	0 - 0.5	C	C		
SF-SS-20	0 - 0.5	C	C		
SF-SS-21	0 - 0.5	C	C		

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NOTES

(1) Hydro punch sampling will generate soil samples that will be field screened. Selected soil samples may be selected for on-site laboratory screening.

(2) Hydro punch water screening for total uranium by laser phosphorescence.

(3) Surface samples SF-SS-01 through SF-SS-15 will be collected at the same location as the soil borings. Surface samples SF-SS-22 through SF-SS-25 are sediment samples to be collected in drainages.

(4) Existing monitoring wells will also be sampled. These include 1046, 1433, 1516, 1517, 1518, 2046, 2385, 2401, 1014, 2014.

TARGET ANALYTE LIST 20.03.05 A Through I:

[A] Water/Soil - total Uranium

[B] Groundwater/Surface Water - Full HSL, Full Rad., Misc. Rad., Gen Groundwater Quality

[C] Soil/Sediment/Sludge/Waste - Full HSL, Full Rad., Misc. Rad.

[D] Classification Tests

SG = Specific Gravity
W = Water Content
γd = dry unit weight
LL = liquid limit
PL = plastic limit
Grain Size
SA = Sieve Analysis
HA = Hydrometer Analysis

[E] Con = Consolidation test

[F] HC = Hydraulic Conductivity

Strength Tests

[G] UC = Unconfined Compression
CIU = Consolidated Isotropic Undrained
DS = Direct Shear

[H] TCLP (Toxicity List)

[I] TCLP plus Cu, Fe, Mn, Zn

8.3 FIELD OPERATIONS

8.3.1 Geophysical Investigations

Surface geophysical grid surveying will be performed to identify potential buried concrete rubble or other potentially contaminated debris. Magnetometer surveys are useful for the detection and delineation of subsurface ferromagnetic materials such as drums, construction steel, etc. These materials exhibit magnetization induced by the earth's magnetic field. If this induced magnetic field is strong enough, it can be detected and recorded as an anomaly in the earth's field. Electromagnetic Terrain Conductivity (EM) is used to measure the apparent conductivity of earth materials in the shallow subsurface. EM is useful in detecting and mapping shallow stratigraphic or materials changes, delineating contaminant plumes and landfills, and in the investigation of other shallow subsurface features that exhibit anomalous electrical properties in comparison with the surrounding earth.

Magnetometer and EM techniques will be used to survey the South Field on north-south lines placed at a spacing of 50 feet; actual field procedures will be those commonly used by industry, and as proposed by a third-party contractor. Data recordings will first be taken at intervals of 50 feet, processed and plotted on existing FEMP maps. Exceptionally strong anomalies or those indicated by both techniques will be re-surveyed on 25-feet grid spacings to confirm and further delineate lateral and calculated vertical extent. Subsequent trenching, and subsurface investigations and sampling will be performed at up to ten of the strongest anomalies, as described in Sections 3.1.5 and 8.3.6. Designation of anomalies for excavation will be the responsibility of the OU 2 Manager.

8.3.2 Soil Gas Survey

Volatile organic vapors were detected while excavating trenches in the solid waste landfill in July, 1992, suggesting that volatile organic vapor may be associated with some of the waste materials disposed of in this unit. A soil gas survey is proposed to locate sources of organic contamination in the shallow disturbed subsurface. Gas samples will be collected directly and analyzed by flame ionization detector. Gas sampling points will be located on a grid based on the reported east-west orientation of disposal cells in the landfill. Approximately 33 total sampling points will be located with an east-west spacing of 50 feet, and a north-south spacing of 20 feet. The north-south spacing will be staggered to increase the probability of encountering the waste disposal cells rather that the native soil separating adjacent cells. Gas samples will be collected in a more dense pattern around areas where contaminants are known or suspected based on previous sampling, and the observations of waste types encountered during the 1992 trenching activity. The results of the soil gas survey will be used to optimize the selection of locations of subsurface borings and soil sample collection.

8.3.3 Field Screening

All soil samples will be screened in the field for volatile organic vapor with an Hnu and screened with an ESP-1, Model 141, SPA-3 Sodium Iodine Scintillation Detector survey instrument for radiation. All samples will be visually described, and all sample collection points will be surveyed to define the surface elevation and the northing and easting location. Samples which exhibit screening levels greater than 10 times background will be considered "elevated" and will be selected for further laboratory analysis. Samples which exhibit screening levels greater than 100 times background will be considered "highly elevated".

Springs observed to flow from the side of a waste unit into a drainage will be sampled after developing the flow. See Sampling Surface Water for the sampling method. All spring samples will be screened by analyzing for total uranium by Laser Phosphorescence. Springs that are highly radioactive will be resampled and a sample split will be sent to the contract laboratory for Full Radioisotope analyses if the second sample is equally contaminated.

The soil vapor sampling equipment, sample collection and analysis, and data recording will be conducted in the following manner:

1. Using a slide hammer, a six foot section of 3/8-inch diameter solid stainless steel rod will be driven vertically into the ground at the sampling location. The rod will be advanced to a depth of two to five feet, depending on investigation objectives.

2. The solid rod will be withdrawn and replaced with a 1/4-inch diameter hollow stainless steel tube to a depth of approximately six inches above the bottom of the hole created in step 1 above.

3. Prior to installation of the 1/4-inch tube, a length of stainless steel cable will be placed into the tube so that approximately six inches of the cable is allowed to protrude ou the bottom of the 1/4-inch tube, to prevent clogging.

4. After successful installation of the 1/4-inch tube in the hole, modeling clay will be tamped around the tube at the surface and cable will then be withdrawn. The clay will be checked for the presence of organic vapors with an HNu Photoionization Detector. If organic vapors are detected then a volclay mix will be used to seal the hole in the upper 3'6" to surface.

5. A teflon or tygon tube will be connected to the top of the 1/4-inch diameter tube. A manual vacuum pump, connected to the teflon/tygon tube, will then be used to withdraw a volume of soil vapor from the hole into a collapsed tedlar bag.

6. The filled tedlar bag, identified with a sample number which corresponds to the soil vapor survey sampling location, will be analyzed by a Foxboro OVA-128 or similar flame ionization detector (FID). The sample will also be measured with a photoionization detector (PID) and recorded.

7. If used, the Foxboro OVA-128 calibration and sampling will be performed in accordance with the manufacturer's "OPERATION AND SERVICE MANUAL FOR CENTURY SYSTEMS Portable Organic Vapor Analyzer (OVA) Model OVA-128 and Optional Accessories, Revision C."

8. Soil vapor survey results will be documented and reported in the appropriate section of the form as shown on Figure 1.

9. Additional information to be document and reported in the appropriate section of form as shown on Figure 1.

10. FID Calibration information will be recorded on Figure 2.

11. All equipment and material used during the soil vapor installation process will be decontaminated prior to use also will be decontaminated between individual hole installations. All stainless steel tubes will be decontaminated prior to use by high pressure steam cleaning followed by drying the tubes with bottled air or nitrogen to eliminate the possibility of cross-contamination between samples. Teflon/tygon tubing and tedlar bags will be replaced after each soil vapor sampling location has been sampled. An adequate supply of tubes will be maintained to complete each day's measurements without reusing a tube.

12. Soil vapor survey field work will be performed only under ambient conditions of temperatures greater than 40 degrees fahrenheit and relative humidity less than 95 percent. When ambient conditions of temperature and humidity are not within the above specified range, the soil vapor survey will not be performed.

Solid Waste Landfill

The locations for some of the waste sampling to be conducted with a bucket auger will be selected from the highest readings found during the proposed soil gas survey. The material excavated by the auger will be screened, and a sample will be collected from the most radioactive interval or the interval having the highest volatile organic vapor reading.

The locations for 10 to 15 borings in the reported waste cell area will be selected based on the highest readings found during the soil gas survey. Initially, these borings will be advanced using a nominal 12-inch diameter bucket auger to facilitate collection of waste materials. Waste material recovered from each lift of the bucket auger will be field screened and a sample for contract laboratory analyses will be selected based on the following:

- the interval with the highest radioactive reading, or
- the interval with the highest volatile organic vapor reading, or
- two samples if the maximum readings occur at different depths.

All samples will be visually described. TCLP analysis will also be performed on the sample that contains the highest volatile organic vapor reading to support hazardous waste disposal determinations.

Samples of highly elevated radioactivity (100 times background and above) will be candidates for on-site screening by Gamma Spectrometry to define uranium isotopes, thorium isotopes and radium isotopes. If thorium or radium predominate the radioactivity, then additional investigation may be required to define the source of this material.

After the waste has been sampled borings will continue using hollowstem augers and split-spoons until native till is encountered. A sample will be selected from 5' below the native till/waste contact for contract laboratory analyses if field screening indicates background radiation levels in the soil. Borings will be terminated within the disposal cell if groundwater is encountered, and a filtered water sample will be submitted for on-site laboratory analysis for total uranium.

Groundwater samples from all new and existing wells will be laboratory screened for total uranium by x-ray phosphorescence, and the results compared against historical trends in uranium concentrations. Wells that produce samples containing high or low values compared to historical results will be developed to remove an additional 3 well volumes prior to sampling for the Full Radioisotope parameters (TAL B).

Lime Sludge Ponds

The trenching activity, planned for the K-65 area, will be carefully monitored to detect elevated radioactive sources. Samples of elevated radioactive material, as determined by 10 times the background readings of the radioactivity meter, will be collected at a maximum frequency of one sample per 5 linear feet of the trench. This is estimated to generate an estimated 60 samples. The most radioactive sample for each 15 that are collected will be selected for contract laboratory analyses. A split of this sample plus an additional sample will be sent to the on-site lab for analysis by Gamma Spectroscopy and X-ray fluorescence for total uranium, total thorium, uranium isotopes, thorium isotopes and radium isotopes.

Groundwater samples from all of the wells will be laboratory screened for total uranium by laser phosphorescence, and the results compared against historical trends in uranium concentrations. Wells that produce samples containing high or low values compared to historical results will be developed to remove an additional 3 well volumes prior to sampling for the Full Radioisotope parameters (TAL B).

Inactive Flyash Piles

There are 4 soil media of interest in the Inactive Flyash Pile. These include surface cover soil, ash materials, non-ash fill material and native soil/till. Each of these materials will be sampled by continuous split spoons as borings are advanced. The sample with the highest screening reading from each media will be properly preserved and retained for possible analysis. The goal is to select a highly contaminated sample of each of the media.

Hydropunch ™ sampling will be conducted if saturated conditions are encountered. The water sample collected during hydropunch sampling will be sent to the on-site laboratory for total uranium analysis by x-ray fluorescence. A soil sample collected from the same interval may be sent to the on-site lab for total uranium analysis by x-ray fluorescence if field screening indicates elevated radioactivity.

Active Flyash Pile

No screening analyses are proposed during sampling activities conducted at the Active Flyash Pile.

South Field

Surface geophysics are proposed to locate and interpret the relative significance of geographical anomalies i.e. (quantity of concrete, wood and other large pieces of building materials). The rem most significant anomalies, as determined by a geophysicist, will be investigated by trenching or by digging a pit. A surface wipe sample will be collected from the most radioactive waste material as determined by field screening. The wipe sample will be analyzed in the on-site lab for total uranium and total thorium by x-ray fluorescence and for isotopic uranium and isotopic thorium by gamma spectrometry. If the soil beneath the rubble is determined to be radioactive, a sample of the soil will be obtained from the bucket of the backhoe for on-site analysis by gamma spectrometry.

Hydropunch ™ groundwater samples will be collected if saturated soil conditions are encountered. The water sample will be analyzed on-site for total uranium by laser phosphorescence. A soil sample from the saturated zone will also be submitted for on-site lab analysis if elevated radioactivity is detected in the sample. The soil sample will be analyzed for total uranium by x-ray fluorescence.

8.3.4 Surface Soil Sampling

Surface soil sampling locations will be selected based on criteria established for each subunit investigation (see Section 3.0). Sampling will be limited to the upper horizon, or 0 to 6 inches maximum in depth.

Upon identification of the sampling locations, surface soil sampling will be performed by the use of a stainless steel, (minimum 3-inch diameter) bucket auger or stainless steel trowel as necessary. To ensure representativeness of soil samples collected, prior to sampling a two square feet area will be identified. Actual samples will consist of a composite of the sampling of material from the four corners and center of the two square feet area.

Immediately after the sample is taken, the soil will be transferred to a stainless steel bowl where the sample will be removed from the auger bucket, if necessary, by the use of a stainless steel trowel. The sample will be field screened for radioactivity and organic vapors, and the results recorded on the appropriate field form. The soil will then be reduced to a homogeneous mixture and placed into the appropriate sampling container. Soil sampling equipment will be decontaminated prior to sampling the next location.

8.3.5 Subsurface Soil Sampling

8.3.5.1 Soil Borings

Soil borings will be installed using a truck-mounted hollow-stem auger drill rig and split-spoon or Shelby Tube type sampler for fill/soil sampling. After sampling objectives have been accomplished, each boring will be plugged with Volclay grout from the bottom to surface through the hollow stem auger or via a tremie pipe; after grout has settled, a minimum of a 12-inch cement plug will be placed in the hole.

Continuous samples will be collected in advance of the hollow-stem auger described above, from six-inches below surface to planned total depth. All samples will be field screened with beta/gamma and photoionization detectors, and values recorded. Depending on the subunit, various samples of both fill and glacial till with the highest radiological response above background will be analyzed at a contract RI/FS laboratory.

In each Hydropunch ™ boring in the Inactive Flyash Pile and Southfield, only the sample in the saturated interval of till having the highest radiological response will be analyzed at the RI/FS lab. Samples sent to the contract lab will be split for gamma-spectrometry analysis at the FEMP laboratory.

8.2.5.2 Sludge Sampling

Hand augering will be used to collect near surface soil and sludge samples in the Lime Sludge Pond subunit. Either a 3-inch or 4-inch stainless-steel bucket auger and extension rod will be used to sample to maximum depths of 12 inches. Excessive free liquid shall be allowed to drain from each sludge sample prior to containerizing. Samples will be removed from the hand auger bucket with a stainless steel trowel or pick as consistency permits. Augers will be decontaminated between each sample point.

8.2.5.3 Waste Sampling

Waste materials are anticipated to be in a solid form wastes may be collected using a stainless steel hand auger (minimum 3-inch diameter) or a drill-rig driven bucket auger (nominal 12-inch diameter). All wastes identified for possible sampling will be field screened with a photoionization detector and radiological survey meter. If field screening requires that a sample be taken, the sample will be collected from the auger using a stainless steel hand trowel. Each sample will be placed into a stainless steel bowl, reduced to a homogeneous mixture, then placed into the appropriate sampling container.

In the solid waste landfill, waste sampling will be performed at 10 to 15 locations using a truck-mounted auger bucket approximately 12-15 inches, depending on availability. Samples will be taken through the waste to a depth of 6 and 20 feet and screened for radiological contamination. The sample with the highest reading will be analyzed for Full HSL and Full Radioisotope parameters. All other waste samples collected in other subunits will also be analyzed for the parameters specified in TAL 20.03.05 C.

Sampling equipment will be decontaminated prior to performing sampling at the next location.

8.3.6 Trench Investigations

To determine if rubble/debris is a source of contamination to surrounding subsoils and groundwater, excavation using a backhoe will be performed at suspect locations in the Southfield (see Section 8.3.1). Excavation procedures for trenching, screening, sampling, and re-grading are not defined in either the SCQ or RI/FS QAPP and are presented in this section.

Maximum length and depth of excavation will vary according to surface conditions in the K-65 area or to calculations based on the size and intensity of a geophysical anomaly; in no case will excavation depth exceed 15 feet (6 feet in the K-65 area) or intercept any perched groundwater zone.

Prior to trenching, the area to be excavated will be surveyed and clearly marked by surveyor's stakes to define the end points and center-point of the longitudinal centerline of the anomaly indicated by geophysical surveying.

Trenching will begin at the center-point of an anomaly and proceed toward either end. If no debris or waste materials are encountered by the midpoint of the segment, the backhoe will return to the center-point and begin trenching in the opposite direction. If clear evidence of debris or waste material is encountered, then trenching will continue in that direction until the project geologist determines that native or naturally occurring materials have been encountered. Completion of the first segment will not be accomplished if only native materials are found in the second segment.

If groundwater is encountered during trenching, then that section of the trench will be temporarily abandoned, the backhoe moved to another position along the centerline, and a new excavation will commence. The operator will provide at least a two-feet earthen berm between the abandoned trench excavation which contains groundwater and the new trench excavation. The new excavation will be installed at a depth more shallow than that which encountered groundwater. If groundwater is again encountered, no attempt will be made to sample, control the flow, or remove accumulating groundwater.

Under no circumstances will anyone enter the trench. In addition, the project geologist shall ensure that access to viewing is controlled by barricading the excavated area back a distance of at least 5 feet from the trench. If the trench sidewalls are not stable, no one will be allowed to approach within 10 feet of the trench. Soil debris, or waste material will be taken from the bucket of the backhoe for sampling. All sampling will be performed at the discretion of the project geologist. During and following excavation of the trench, the project geologist shall construct a cross-section profile of one sidewall of each trench. The cross-sections shall contain sufficient detail to prepare figure for inclusion in a final report. Cross-sections shall show all significant soil, subsoil and unconsolidated material, and differentiate depositional, lithologic, or visual differences revealed in the trenches. Areas of fill, debris, or other obvious cultural-related fill material shall be clearly labeled and shown on the cross-sections.

Upon completion of the cross-sections, and if sidewalls are stable, a vertical radiological survey of one of the sidewalls of each trench shall be performed. This survey shall be performed by the use of a SPA-3 probe attached to a wooden pole, which has been graduated to show trench depth. The vertical radiological survey, or profile, shall be performed at five-feet intervals along the trench sidewall. Vertical meter readings shall be performed every two feet, or at lithologic change, or fill boundaries and recorded on the field activity daily log sheets. Actual meter readings will be noted by a technician standing across the trench from the meter location. If necessary, the technician may use binoculars to read the meter scale. Upon completion of the radiological survey, the results will be recorded on the project geologist's trench cross-sections.

As material is removed, samples will be collected from the backhoe bucket and screened as per Section 8.3.3. Undisturbed native materials will be sampled only if screening elevated or highly elevated readings. If no previous disturbance of the soils or soil material is evident and no elevated field readings are observed, samples will not be submitted to the contract laboratory.

If radiologically contaminated waste material is encountered, this material, if small enough in volume, will be placed in a sea-land container specified for the purpose of receiving excavated material. If feasible, an inventory and volumetric estimate of the waste shall be done and included in the Field Activity Daily Logs. If radiologically contaminated waste is encountered which is shown to be too large for containerization, it shall be placed in a controlled area and stored until further disposition of the material can be performed. Final disposition of this material is beyond the scope of this work plan.

Upon completion of the investigation at each trench, it will be backfilled with uncontaminated materials which were removed during the excavation. Otherwise, clean fill will be used. The area will then be graded and returned to its approximate original contour and slope. Trenching should be accomplished at a minimum rate of one trench per day. If, for any reason, it is necessary to leave any trench open overnight, the area surrounding the trench shall be barricaded and clearly marked. If rain is forecast, the trench will be covered with available materials to prevent inflow. Under no circumstances shall a trench be left open during a weekend.

At the discretion of the project geologist, if determination is made that nothing except undisturbed soil and subsoil materials have been encountered, then trenching shall be terminated at that location. Also, the project geologist has the option of recording trench condition with photographs. Photographs shall become a part of the permanent record of the project, and shall be included in the final report. Prior to demobilization of the backhoe from a trench site, the geologist shall inform the responsible SC/DM and OU 2 RI/FS staff for their concurrence.

Between trenches only the backhoe bucket will be decontaminated. Decontamination will be accomplished at the designated FEMP decontamination area. The bucket will be removed from the backhoe, placed in the bed of a pick-up, secured from movement, transported to the decontamination area, decontaminated by the use of steam cleaning, then placed on clean plastic sheeting, placed back into the pick-up truck, taken back to the project area, and reinstalled on the backhoe.

8.3.7 Hydropunch ™ Groundwater Sampling

Hydropunch ™ sampling is proposed in the Southfield to collect groundwater samples in saturated till deposits if present. The Hydropunch ™ will be used in conjunction with hollowstem auger drilling. Groundwater samples will be analyzed for total uranium by Pulsed Laser Fluorescence in the on-site laboratory. These analyses are expected to yield a total uranium concentration accurate to 0.10 parts per million (ppm) within 24 hours of collection.

Locations for sampling will be initially selected in a radial pattern around Wells 1433 and 1711, in the northwest corner of the Southfield and northern Inactive Flyash Pile, respectively. The procedure for selecting locations is as follows:

- A number of fixed sample locations are proposed, and these will be completed regardless of the findings during field activities. These locations are shown in Figure 8-6, and include the following:

  1) A sample between Well 1433 and Well 1711;
  2) A sample between Well 1433 and Well 1047;

3) A sample between Well 1711 and Well 2402;
4) A sample between Well 1433 and Well 1046, and
5) At least 2 samples collected south of Well 1433.

- Collection of additional samples (estimated to be approximately 5) will be based upon the results of the fixed sample location data.

- A contingency of up to 10 additional Hydropunch ™ borings is allowed in the event perched groundwater is laterally continuous and contamination is widespread.

The procedure will be to drill borings and collect soil samples for lithological description. The expected depth to water at the sampling site can be reasonably estimated from nearby wells, and a hydropunch sample will be collected once saturated conditions are encountered in soil samples recovered from the borings. Hydropunch ™ samples will not be collected if clay soil or un-saturated soil conditions are encountered. Groundwater samples will be delivered to the on-site lab and analytical results reported within 24 hours.

8.3.8 Well Installations

8.3.8.1 Installation of 1000-Series Wells

The 1000-Series wells will be drilled with a truck-mounted auger rig using nominal 8-inch or 10-inch hollow stem augers as available. Continuous split-spoon samples will be collected for archive in advance of the auger, through the till to an approximate maximum depth of 20 feet. Borings will completed using 2-inch diameter, 316 stainless steel riser and .010-inch slotted screen across the perched water interval. Filter pack will be well-sorted quartz sand, ranging between 10-20 mesh (coarse) and 20-40 mesh (medium).

8.3.8.2 Installation of 2000-Series Wells

The 2000-Series wells will be drilled with a cable-tool rig, using a nominal 10-inch diameter drill casing to an approximate maximum depth of 50 feet. Several designated 2000-Series wells in waste or contaminated areas will require telescoping of casing through the till. Depending on the combined thickness of the fill and till, approximately 35 feet of nominal 12-inch inner-diameter steel surface casing will be cemented in place; drill casing of 14 to 16 inches will be used to ensure adequate annular cement thickness. The cement will be allowed to cure for a minimum of 24-hours before continuation of drilling to the planned total depth.

Continuous split-spoon samples will be taken for archive through the glacial till and at five-foot increments in sand and gravel of the upper Great Miami Aquifer. Wells will be completed using 4-inch diameter 316 stainless steel slotted screen (15-feet) and riser. Either .010-inch or .020-inch screen, and either medium or coarse quartz sand filter pack as defined in the RCRA Groundwater Monitoring Plan, December 1991, will be installed based on field classification of the formation material and sieve analysis.

8.3.9 Groundwater Sampling

One round of groundwater sampling will be conducted within 24-hours of developing the newly drilled monitoring wells and within 24 hours of purging the existing wells. Equipment may include but is not limited to bailers, surge blocks, pumps and hoses. All wells will be developed to archive turbidity-free water (< 5NTU), but no less than five times the standing water in the well. Existing wells will be purged of at least three volumes, if re-charge permits. Parameter specific and general sample collection procedures will be conducted according to the SCQ are RI/FS QAPP. Water levels will be recorded in all proposed new and existing wells prior to sampling to establish baseline information; levels will again be measured in all new and existing wells at the close of the project. Field measurements of water temperature, pH, conductivity and dissolved oxygen will be taken and recorded. Samples will be prepared, shipped, and analyzed at a contract RI/FS laboratory for Full HSL and Full Radioisotope parameters as defined in the attached Target Analyte Lists (TAL20.05.03B).

8.3.10 Surface Water and Sediment Sampling

Sampling personnel will ensure that access to the sampling locations will not result in the inadvertent introduction of nearby materials into the surface water to be sampled. If the waters to be sampled are flowing, the sample will be taken from that portion of the water visually identified as containing the greatest amount of flow to allow for representativeness. Additional care will be taken to avoid the introduction of floating organic material such as leaves, twigs, etc. The sample will be taken with no disturbance to the bottom sediments at the sampling location. Downstream samples will be collected before upstream samples.

Prior to sampling, the grab bottle to be used will be rinsed a minimum of three times in the water to be sampled. Rinse water will be placed back into the surface water body at a location which will not interfere with the selected water sampling location. Water samples to be collected downstream from discharge locations will be taken in the mixing zone to ensure representativeness of the samples being collected.

Actual sampling will be accomplished by the use of a grab bottle. If necessary, a length of rope or an extension pole will be attached to the grab bottle. The sample will then be transferred to the sample container allowing minimal disturbance. A specified amount of water will be transferred to a separate container for field parameter analysis. A field determination of temperature, conductivity, and pH will be performed.

The sampled water will be placed into the appropriate container, with preservative, if required, capped and placed into a cooler. Water sample analysis will be for the parameters specified in TAL 20.03.05 B.

Stream sediment samples will be collected from surface water bottom deposits. Sediment samples will be collected from downstream sampling locations first, then working upstream with additional sampling necessary. Sampling will be performed by the sampling crew with a minimum disturbance to the bottom sediments which are adjacent to the selected sampling point. Stream access will be achieved by the sampling technician walking down the stream bank to the sampling location.

Sediment, if relatively unconsolidated, will be taken by the use of a glass or plastic grab bottle. If the sediment is well compacted, it will first be loosened prior to sampling by the use of a stainless steel trowel, then collected with a grab bottle. The sediment will be allowed to dewater by draining for a period of two minutes prior to emplacement into the sample collection container. During the sample dewatering period, the sample will be undergoing field screening for radiological activity and the presence of organic contamination.

In order to provide representative samples, the sediment sampling locations will be selected at instream flow locations, which, generally consist of sediment accumulations which lie at the lowest elevations within the surface water channel. If sediment sampling occurs when no flow exists in the stream, sediment samples will be taken at points which under normal flow conditions would contain flow.

For sediment samples to be taken at nonflowing surface water locations, sampling will consist of obtaining bottom sediments with a stainless steel trowel. For sampling locations where the standing water is too deep for trowel sampling, a stainless steel bucket auger. The collected samples will be allowed to dewater for a period of two minutes, during which time field screening for radiological activity and the presence of organic constituents will be performed.

It is anticipated that access difficulties for some sediment sampling will be encountered during this sampling effort. If this becomes a problem, then a sampling platform or a "manlift" will be utilized to expedite the sampling. Any sampling methodology used will be established and approved prior to sampling by the responsible health and safety personnel assigned to this project.

Sampling equipment will be decontaminated prior to performing sampling at the next location. Any rope used for sampling purposes will be disposed as radiologically contaminated wastes.

8.3.11 Waste Handling/Disposal Section

During the performance of this field work, wastes in the form of excess surface water, sediment, sludge and solid wastes sampling media, contaminated well purge water, contaminated sampling equipment, contaminated drilling equipment, contaminated PPE, drill cuttings, and decontamination wastes will be generated.

Contaminated (or assumed to be contaminated) solid wastes, such as soil, sediment, sludge and solid wastes will be reintroduced back into the sampling location.

Contaminated drill cuttings will be placed in clean 55 gallon drums, labelled according to project and location of origin, and dispositioned to the designated waste interim storage location for future characterization, disposition and disposal.

Contaminated PPE, consisting of disposable items, will be labeled as radiological wastes and placed in the designated disposal containers, labeled and sent to the wastes interim storage location.

Decontamination of drilling and sampling equipment will be performed at the FEMP Decontamination Area. Fluids and any solid materials generated will be handled in accordance with the normal operation of that facility's contamination treatment/control devices.

Well sampling purge water will be disposed in the FEMP General Sump.

8.3.12 Project Surveying

Land surveying will be performed at all necessary sampling, boring, geophysical, and well drilling locations. Surveying will be performed by a Registered Professional Land Surveyor. All surveyed locations will be accurate to the nearest 0.01 feet accuracy. Survey points will be located and integrated into the existing FEMP Geographic Information System (GIS), and incorporated into the site data base.

8.4 GENERAL SAMPLING REQUIREMENTS

8.4.1 Field QA Samples

Field QA samples will be collected during the field work within each of the OU 2 subunit investigations. Trip blanks and preservative blanks will be provided by the Quality Assurance group with the remaining samples prepared or collected by the sampling teams. The QA sample types and rationale for selection follows.

- Trip blank samples will be prepared in a controlled environment by pouring distilled water meeting the ASTM Type II standards into 40 mL vials used for volatile organic analyses (VOA). A trip blank for VOA shall accompany each sampling team during each day's sampling to the field location followed by shipment to the laboratory with the field samples for analyses. Trip blanks are required during sampling events for all media types when the target analytes are comprised of volatile organics for ASLs C, D, and E.

- Field blank samples will be prepared for every 10 groundwater and/or surface water samples and analyzed for the same target analytes specified for the field sample collected during the sampling event. The 1/20 frequency of field blanks is based on the number of groundwater/surface water samples collected from each OU 2 subunit. A field blank samples are prepared at the sampling site by the field team by pouring deionized/organic free water into the appropriate sample containers specified in Table 8-12 (Section 9.3.5).

- An equipment rinsate sample will be collected for every 10 field samples of any media type following decontamination of the sampling equipment. A sampling event entailing Full HSL and Full Radioisotope parameters should be chosen for the rinsate samples and collected in conjunction with a sampling event having the highest potential for contamination coming in contact with the equipment. This will assess the effectiveness of the field decontamination procedures.

- Duplicate water samples will be collected at a frequency of one per every 20 groundwater or surface water samples. The duplicate samples should be collected at sampling locations which are known or suspected of being contaminated. These samples should be assigned a unique sample number and sent to the laboratory as a blind sample.
  No duplicate soil samples will be collected due to the lack of an effective field compositing technique which would produce

meaningful data where discrepancies could absolutely be considered a laboratory precision problem.

- One preservative blank for each type of preservative used will be prepared and analyzed for the respective parameters of interest. This will consist of analyses of separate ASTM Type II water samples preserved with each respective acid and base preservative. The HCl acid-preserved sample will be analyzed for volatile organic compounds, the NaOH-preserved sample for cyanide, and the HNO_3-preserved sample for metals.

- Container blanks will not be included in the QA samples since all containers used for RI/FS sampling activities are pre-cleaned by the manufacturer and have a certificate of analysis for each lot of containers.

8.4.2 Alternate Sampling Procedures

The implementation of alternate sampling procedures could be necessary if any unanticipated problem developed during the field investigative effort. Alternate sampling procedures, or deviations, consist of either work plan variances or work plan non-conformances.

If it becomes necessary to deviate from a sampling standard operating procedure, such a deviation will be handled in the following manner:

1. The field sampling technician or geologist identifies the need to deviate from the sampling plan or procedure.

2. The technician brings the problem to the attention of field crew management and makes recommendations about how to best proceed with sample collection with minimal impact to the existing sampling procedures and project data quality objectives.

3. SC/DM project management staff consult with the OU 2 management staff and data users about the problem, and evaluate possible solutions and the impacts of the solutions on the project data quality objectives.

4. Based on the input from OU 2 and SC/DM staff a solution is determined.

5. SC/DM staff implement a Variance Request Form (Attachment B) which describes the nature of the variance, the need for the variance and how variation from the Sampling and Analysis Plan will minimize or have no impacts to the project data quality objectives.

6. SC/DM and OU 2 staff receive the necessary variance approvals from the OU 2 Quality Assurance and Program Management staff.

7. The approved Variance Request form becomes a part of the overall project historical file.

Variance approvals will, in most instances, be obtained prior to the actual performance of the variance in the field. However, depending on the situation, prior variance approval may not be feasible due to practical aspects associated with the field work being performed.

Work plan non-conformances are defined as field or laboratory activities which have been completed, but are subsequently found to not have been performed according to the work plan. A non-conformance may have a significant impact on the useability of field or laboratory derived investigation results. Resolution of a project non-conformance will be the responsibility of the OU 2 data user.

8.4.3 Sample Equipment and Materials

All environmental media to be sampled will be sampled with equipment which is functional, designed for the specific purposes of the sampling event, and has been properly decontaminated. Sampling will be accomplished with equipment which is constructed of nonreactive materials.

Sampling containers to be used will be composed of materials which are commonly used for the type of media to be sampled. All sample containers will be of the volume necessary for laboratory analysis purposes. Appendix B a list of common equipment to be used per type of sampling activity.

8.4.4 Equipment Decontamination

All drilling installation, trenching, and media sampling equipment will be decontaminated in accordance with SCQ, Appendix K, specifications.

8.4.5 Sample Volume, Containers and Preservation

The sample containers will be pre-cleaned by the manufacturer and accompanied by a certificate of analysis. The sample container types and preservative requirements are specified in the FEMP SCQ and are summarized in Tables 8-11 8-12 for aqueous and solid matrices, respectively. The sample volumes are consistent with the contract laboratory requirements.

8.4.6 Sample Collection Field Forms

Both surface and groundwater samples collected in the field are documented on the **SAMPLE COLLECTION LOG**, and **WATER QUALITY FIELD COLLECTION REPORT** forms. An example of these forms is shown in this report as Appendix C.

The collection of soil and sub-soil materials are documented on the following forms:

SAMPLE COLLECTION LOG

VISUAL CLASSIFICATION OF SOILS

SUBSURFACE SOIL SAMPLE COLLECTION LOG

Examples of the above specified forms are shown in Appendix C.

In addition to the above specified forms, daily field activities are recorded on the **FIELD ACTIVITY DAILY LOG** form. This form is included in Appendix C in this report.

8.4.7 Sample Collection Field Report

No specific sample collection field reports are proposed for this project. Rather, the information contained in the field forms specified in Section 8.4.6 of this report serve as the basis for documenting all significant aspects of the sample collection activities.

Upon completion of the project, all significant task related information, including copies of field forms generated, and laboratory related forms, including analytical results of samples taken, are included in a Task Closure Report, or TCR. This report is initiated by the Site Characterization/Data Management Depart of the Environmental Division, and will be sent to OU 2 staff for their records.

TABLE 8-11

SAMPLE VOLUME, CONTAINERS, AND PRESERVATION - WATER/QA SAMPLES

Parameter	Container	Preservation
Volatile Organic Compounds (VOC)	3 x 40 mL amber glass	4 °C/HCl
Semi-VOC (SVOC)	1 x 4L amber glass	4 °C
Pesticide/PCB Compounds	1 x 4L amber glass	4 °C
Inorganics (metals)	2 x 1 L plastic	HNO_3/4 °C
Phenols	1 x 1 L amber glass	4 °C/H_2SO_4
Nitrates	1 x 1 L amber glass	4 °C/H_2SO_4
Ammonia, TON, Total Phosphorous	1 x 1 L plastic	4 °C/H_2SO_4
Chloride, Fluoride, Sulfate	1 x 1 L plastic	4 °C
Sulfide	1 x 1 L amber glass	4°C/NaOH/ Zn Acetate
Cyanide	2 X 1 L plastic	NaOH/4 °C
TOC	1 x 500 mL amb. gls.	4 °C/H_2SO_4
TOX	1 x 1 L amber glass	4 °C/H_2SO_4
Radioisotopes (Full Radioisotope)	1 x 4 L plastic	HNO_3
Gross Alpha/Beta	1 x 1 L plastic	HNO_3
Total Thorium	1 x 1 L plastic	HNO_3

TABLE 8-12

SAMPLE VOLUME, CONTAINERS, AND PRESERVATION - SOIL/WASTE SAMPLES

Parameter	Container	Preservation
Volatile Organic Compounds (VOC)	3 x 40 mL amber glass	4 °C
Semi-VOC (SVOC)/Inorganics	1 x 120 mL glass	4 °C
Pesticides/PCBs	1 x 500 mL glass	4 °C
Radioisotopes (Full Radioisotope)	1 x 1 L glass	None
Gross Alpha/Beta	1 x 250 mL glass	None
Total U/Th	1 x 250 mL glass	None

8.5 SAMPLE MANAGEMENT

8.5.1 Sample Identification and Labeling

Consistent with past FEMP RI/FS projects, a unique six-digit sample number will be assigned to each sample collected. Specific number ranges will be allocated for each OU 2 subunit being characterized. Each sample container will also be affixed with a RI/FS label containing, at a minimum, the information specified on Form 7-2, Appendix B of the FEMP SCQ.

8.5.2 Sample Chain of Custody Records and Field Data Documentation

Sample custody procedures as outlined in the FEMP SCQ will be adhered to throughout the sample handling process from field collection to shipment or delivery of the samples to the laboratory. A combined Request for Analysis/Chain of Custody (RFA/CC) record will be used to document collection data, chain of custody, and the analytical parameters requested for each sample in accordance with FEMP RI/FS procedure FPP-401. The Site-Wide Analysis Request/Custody Record (SAR/CR) form will be completed for all samples delivered to the on-site sample processing laboratory.

In addition to the custody records, a RI/FS Sample Collection Log will be completed which summarizes all samples collected from a single borehole or monitoring well. A Groundwater Quality Report will be prepared for each well sampling event to document the well purge data and groundwater conditions prior to sample collection. A Visual Classification of Soils form and Well Installation Diagram will be completed for soil borings and well installations when appropriate. Furthermore, all field investigation work is documented in detail on a daily basis using the Field Activity Daily Log form.

8.5.3 Sample Packaging, Storage, and Shipping

All samples shipped to the contract laboratory will be screened for gross radiological levels (gamma) using a sodium-iodide detector. External wipe samples of each sample container are also counted for gross alpha and gross beta contamination. Sample shipments are classified in accordance with USDOT regulations based on the radiation levels and origin of the samples.

Immediately upon collection, sample parameters requiring storage at 4°C ± 2°C are placed in sample coolers to control the temperature until they are relinquished to the sample processing unit where the samples are refrigerated as required. Sample custody seals are verified and examined before packaging the samples with artificial ice and vermiculite to maintain sample integrity enroute to the lab. Sample packaging is performed in accordance with RI/FS procedure FPP-601 and the FEMP SCQ, which are currently being transitioned and integrated into one sample shipping procedure.

8.6 FIELD EQUIPMENT METHODS

8.6.1 Calibration of Field Equipment

Field equipment to be used during this investigation is divided into the categories of health and safety monitoring, field screening and monitoring, and geophysical investigative instruments. At a minimum, all equipment will be operated and calibrated according to the equipment manufacturer's specifications. All instruments are calibrated once per week, or once per day, depending on the manufacturers specifications. Written logs of equipment calibration are maintained by the appropriate personnel in charge of performing the instrument calibrations.

Health and Safety monitoring equipment consists of the following instruments:

Hnu PI-101 Photoionization Detector - equipped with a 10.2 EV lamp. This instrument is calibrated daily using isobutylene gas as a standard. During use, in order to spot check the instrument for proper operation, a hydrocarbon based felt tipped pen is commonly used. However, this practice is not a substitute for routine instrument operation checks.

Ludlum Model 12 Alpha Meter - equipped with a 'pancake probe'. The instrument is calibrated against a background concentration. If the background concentration exceeds 2 counts per minute (cpm), then the instrument is not used. The instrument is calibrated to a known standard once per week.

Ludlum Model 2 BetaGamma Meter - This instrument is calibrated once per week against a background standard. If, during routine use, the operator notes that the background concentration exceeds 300 cpm, then the instrument is not to be used.

Ludlum Model 19 Micro-R-Meter - this meter is calibrated to a known standard once per week.

Ludlum Model 9 Ion chamber - This instrument is calibrated to a known standard once per week.

Field Screening and Monitoring equipment consists of the following instruments:

Hnu PI-101 Photoionization Detector - equipped with a 10.2 EV lamp. This instrument is calibrated daily using isobutylene gas as a standard. During use, in order to spot check the instrument for proper operation, a hydrocarbon based felt tipped pen is commonly used. However, this practice is not a substitute for routine instrument operation checks.

Orion Model 250A pH Meter - This instrument is calibrated daily, and is compared to known calibration standards at least twice prior to each reading. The buffer solutions typically used for calibration are pH 4 and pH 7 Standard Units.

YSI Model 33 S.C.T. Conductivity Meter - The conductivity meter is calibrated daily to a known standard.

Solonist Water Level Indicator - There is no known standard to which a water level meter is calibrated. The meter is, more than calibrated, maintained by ensuring that it is in proper operation, and that the batteries are charged.

Hach Turbidity Meter - This instrument is calibrated to a known standard on a daily basis.

YSI Model 51-B Dissolved Oxygen Meter - This instrument is calibrated to a known standard on a daily basis.

ESP-1, Model 141, SPA-3 Sodium Iodine Scintillation Detector - This instrument is use for radiation surveying and will be calibrated to a known standard on a daily basis.

Geophysical Investigative equipment consists of the following instruments:

Magnetometer - The magnetometer is typically returned to a pre-established base station periodically to calibrate the instrument during surveying. The typical interval is two hours, but may be subject to change depending on survey conditions.

Electromagnetic Meter (EM) - The EM meter is periodically returned to a pre-established base station to calibrate the instrument during surveying. The typical interval is two hours, but may be subject to change, depending on survey conditions.

All instrumentation will be maintained, calibrated and operated according to the manufacturer's specifications or FEMP specifications. Written records of these activities will be maintained in a daily log, chronological format.

8.6.2 Documentation of Calibration

Separate logbooks are kept for each type of instrumentation. The logbooks contain a history no only of the instrument calibration but also of any unusual or irregular problems noted during the use of that particular instrument. Four separate documents are used to record calibration of instruments. Appendix C contains examples of the calibration documentation.

The forms are labeled as follows:

WATER QUALITY FIELD COLLECTION REPORT

WEEKLY CALIBRATION LOG

USE, CALIBRATION, AND MAINTENANCE OF THE HNU PI 101

INSTRUMENT BASELINE DATA SHEET

8.7 ANALYTES OF INTEREST

Target Analyte List

Project specific target analyte lists (TALs) have been developed based on the analytes of interest for the OU 2 RI. These lists are based on the following:

- data gaps from previous investigations;
- the lack of sufficient characterization data in some portions of the subunits;
- the need for consistency with the OU 5 investigation, particularly when addressing fate and transport modeling and risk assessment; and
- the need to define source areas and up- and downgradient extent of contaminant migration across the Inactive Flyash-South Field-Active Flyash areas.

The project specific TALs are given in Appendix D. TAL 20.03.05 B and TAL 20.03.05 C are equivalent to the Full HSL/Full Radioisotope lists for aqueous and solid matrix samples, respectively.

8.8 LABORATORY METHODS

8.8.1 Analytical Methods

The contract laboratory will adhere to the requirements of the SCQ which is currently under revision. EPA CLP or SW-846 requirements will be followed for organic and inorganic analyses. Analytical methods for radioisotopes will follow performance based criteria cited directly by the SCQ. In all cases the laboratory shall generate a CLP data package, or equivalent for non-CLP analytes such as general wet chemistry. The CLP data package will be validatable to ASL D, although for this round of RI sampling only 10% ASL D validation will be initially requested.

8.8.2 Laboratory Performance Requirements

Analytical performance requirements shall be used as guidelines for evaluating laboratory capability to provide specific analytical services to FEMP. Ability to meet these requirements shall be audited prior to contract award as described in Section 12 of the SCQ. Subsequent post-contract-award audits shall be performed to verify laboratory performance using the performance-evaluation sample results specified in Appendix E of the SCQ.

FY93: OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP — FY94: OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP

FIELD INVESTIGATION

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	TOTL FLT	
2B03X59100	5FEB93	11FEB93	5	0	WRITE DRILL SPECS FOR FIELD INVESTIGATN
2B03X59105	12FEB93	26FEB93	10	0	PROCURE SUBS FOR FIELD INVESTIGATION
2B03X59112	22FEB93	26FEB93	5	0	NOTICE TO PROCEED
2B03X59114	22FEB93	9MAR93	12	0	SURVEY NEW BORING/WELL LOCATIONS
2B03X59110	1MAR93	12MAR93	10	0	MOBILIZE FIELD INVESTIGATION
2B03X59116	1MAR93	12MAR93	10	0	PROCESS PENETRATION PERMITS
2B03X59118	1MAR93	5MAR93	5	5	CONDUCT ORR & SITE SPECIFIC TRAINING
2B03X59120	15MAR93	30APR93	34	3	LIME SLUDGE PONDS INVESTIGATION
2B03X59130	15MAR93	5MAY93	37	0	SOLID WASTE LANDFILL INVESTIGATION
2B03X59140	15MAR93	27APR93	31	0	SOUTHFIELD INVESTIGATION
2B03X59142	15MAR93	12APR93	20	17	INACTIVE FLYASH PILE INVESTIGATION
2B03X59144	17MAR93	28APR93	30	5	ACTIVE FLYASH PILE INVESTIGATION
2B03X59160	22MAR93	28JUL93	90	0	SAMPLE ANALYSIS
2B03X59150	6MAY93	12MAY93	5	0	DEMOBILIZATION OF FIELD INVESTIGATION
2B03X59170	2JUN93	25AUG93	60	0	DATA VALIDATION

000118

Plot Date 8MAR93
Data Date 25JAN93
Project Start 1OCT92
Project Finish 4MAY95

CURRENT SCHEDULE
OU2 FIELD INVESTIGATION SCHEDULE
CRU2 PROJECT CONTROL TEAM

Fernald Environmental Restoration Management Corp

Date	Revision	Checked	Approved

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APPENDIX A

EXISTING DQO SUMMARY FORMS

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft 2

1.A. Task/Description: **OU #:** 5

Groundwater Sampling - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA RA OTHER (specify)

1.C. DQO No.: GW-002 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) ____________

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 141; 264 Subpart F; 265; & 300; OAC 3745-64, -81-11, -81-12, -81-15, -81-16, -27-10(f)(5); and DOE Order 5400.5 Chapter II Section 1.d.

4.B.Objective: Monitor groundwater quality at FEMP to assess areal and vertical extent of contamination resulting from site operations including spills, discharges,etc.

---

5. Site Information (Description):

FEMP has potentially contaminated groundwater around the site. A sensitive receptor is the Great Miami Sole Source Aquifer. This aquifer is used as a drinking water source. Groundwater will be sampled at various depths both on site and offsite.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft 2

DQO Number: GW-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X
2. Uranium X
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __
3. BTX __
   TPH __
   Oil/Grease __
4. Cations X
   Anions X
   TOX X
   TOC X
   TCLP __
   CEC __
   COD __
5. VOA X
   ABN X
   Pesticides X
   PCB X
6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section	
ASL A	Screening equip. in RI/FS Sampling Plan	QAPjP Section:	6
ASL B		QAPjP Section:	
ASL C	Analytical equipment	QAPjP Section:	9
ASL D	Analytical equipment	QAPjP Section:	9
ASL E		QAPjP Section:	

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased   Composite   Environmental   Grab   Grid

Intrusive   Non-intrusive   Phased   Source

Other (specify): ______

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: See RI/FS Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft 2

DQO Number: GW-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __

Container Blanks __
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X
Other (specify) __

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 5 & 6

Sediment Sampling - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: SD-002 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) ____________

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 261 & 300; 10 CFR Part 20.101 to .105; and DOE Order 5400.5 Chapter II Section 1.a;

4.B. Objective:

Evaluate magnitude and extent of sediment contamination resulting from site releases of hazardous and/or radiological substances.

---

5. Site Information (Description):

FEMP discharges (e.g., waste water) have potentially contaminated sediments of Paddy's Run and the Great Miami River. [See Site Description for DQO SW-002.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: SD-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium X
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters.

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section
ASL A	Screening Instruments	QAPjP Section: 6
ASL B		QAPjP Section:
ASL C	Laboratory Instruments	QAPjP Section: 9
ASL D	Laboratory Instruments	QAPjP Section: 9
ASL E		QAPjP Section:

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased   Composite   Environmental   Grab   Grid

Intrusive   Non-intrusive   Phased   Source

Other (specify): ______

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Specified in RI/FS Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: SD-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __ ______________________

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Matrix Spike X
Surrogate Spikes X
Other (specify) X Laboratory control samples

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data use will include evaluation of health and environmental risks posed by sediment contamination.

2. Select samples will be tested for grain size analysis using equipment and procedures specified by ASTM.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

1.A. Task/Description: OU #: 1 to 5

Soil Sampling - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R,A OTHER (specify)

1.C. DQO No.: SL-002 DQO Reference No.: None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify)

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 261 & 300; and OEPA "Closure Plan Review Guidance"

4.B. Objective:

Evaluate magnitude and extent of soil contamination resulting from site releases of hazardous and/or radiological substances.

---

5. Site Information (Description):

Discharges or spills from the site have potentially contaminated soils on and off site. These soils may serve as a contamination source to ground water and pose unacceptable risks to human health or the environment. Soil samples will be collected from variable depths.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: SL-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH __
   Temperature __
   Specific Conductance __
   Dissolved Oxygen __

2. Uranium __
   Full Radiologic X
   Metals X
   Cyanide X
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations __
   Anions __
   TOX __
   TOC __
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters.

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section	
ASL A	Screening equipment	QAPjP Section:	6
ASL B		QAPjP Section:	
ASL C	Analytical equipment	QAPjP Section:	9
ASL D	Analytical equipment	QAPjP Section:	9
ASL E		QAPjP Section:	

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased   Composite   Environmental   Grab   Grid
Intrusive   Non-intrusive   Phased   Source

Other (specify): ____

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: Specified in RI/FS Sampling Plan

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft

DQO Number: SL-002

8. Quality Assurance/Control Samples: (Place an "X" to the right of the appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks X
Other (specify) __ ________________

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples X

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Spike X

Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Surrogate Spikes X

Other (specify) __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data use will include evaluation of health and environmental risks posed by soil contamination.

2. Geotechnical testing will be completed following ASTM procedures and specified equipment.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft 2

1.A. Task/Description: **OU #:** 5 & 6

Surface Water - RI/FS

1.B. Project Phase: (Circle the appropriate selection.)
RI FS RD RA R.A OTHER (specify)

1.C. DQO No.: SW-002 **DQO Reference No.:** None

---

2. Media Characterization: (Circle the appropriate selection.)

Air Biological Groundwater Sediment Soil

Surface water Waste Waste water Other (specify) ____________

---

3. Data Use with Analytical Support Level (A-E): (Circle the appropriate Analytical Support Level selection(s) beside each applicable Data Use.)

Site Characterization A B C D E Risk Assessment A B C D E
Evaluation of Alternatives A B C D E Engineering Design A B C D E
Monitoring during remediation activities A B C D E
Other A B C D E (Explain)

4.A. Drivers: 40 CFR Parts 122.41, .44, & 300; DOE Order 5400.5 Chapter II Section 1.a; 10 CFR Part 20.101 to .105; OAC 3745-1-07, -1-32 & -33-05; and ORC 6111.04.

4.B. Objective:

Evaluate magnitude and extent of surface water contamination resulting from site releases of hazardous and/or radiological substances.

---

5. Site Information (Description):

FEMP discharges (e.g., waste water) have potentially contaminated surface waters to include Paddys Run and the Great Miami River. Surface water runoff from FEMP is collected in the Storm Water Retention Basin (SWRB). This water is pumped to a manhole and discharged to the Great Miami River. Also precipitation events of sufficient magnitude may cause overflow of the SWRB into an outfall ditch. This ditch drains to Paddys Run which empties into the River.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft 2

DQO Number: SW-002

6.A. Data Types with appropriate Analytical Support Level Equipment Selection and QAPjP Reference: (Place an "X" to the right of the appropriate box or boxes selecting the type of analysis or analyses required. Then select the type of equipment to perform the analysis if appropriate. Please include a reference to the QAPjP Section.)

1. pH X
   Temperature X
   Specific Conductance X
   Dissolved Oxygen X

2. Uranium X
   Full Radiologic X
   Metals X
   Cyanide __
   Silica __

3. BTX __
   TPH __
   Oil/Grease __

4. Cations X
   Anions X
   TOX X
   TOC X
   TCLP __
   CEC __
   COD __

5. VOA X
   ABN X
   Pesticides X
   PCB X

6. Other (specify) X
   Select samples tested for "extended HSL" parameters. See RI/FS Sampling Plan for additional parameters

6.B. Equipment Selection and QAPjP Reference:

Equipment Selection		Refer to QAPjP Section	
ASL A	Screening equipment	QAPjP Section:	6
ASL B		QAPjP Section:	
ASL C	Analytical equipment	QAPjP Section:	9
ASL D	Analytical equipment	QAPjP Section:	9
ASL E		QAPjP Section:	

7.A. Sampling Methods: (Circle the appropriate selection.)

Biased   Composite   Environmental   Grab   Grid

Intrusive   Non-intrusive   Phased   Source

Other (specify): ____________________

7.B. Sample Work Plan Reference: (List the samples required. Reference the work plan or sampling plan guiding the sampling activity, as appropriate.)

Background samples: One sample collected upstream of plant in Paddy's Run and the Great Miami River.

DQO SUMMARY FORM

Revision: 0
Effective Date: Draft 2

DQO Number: SW-002

7.C. Sample Collection Reference: (Please provide a specific reference to the QAPjP Section and sub-section guiding sampling collection procedures.)

Sample Collection Reference: FEMP QAPjP Section 6

---

8. Quality Assurance/Control Samples: (Circle appropriate selection(s).)

8.A. Field Quality Assurance Samples:

Trip Blanks X
Field Blanks X
Equipment Rinsate Samples X
Preservative Blanks __
Other (specify) __

Container Blanks X
Duplicate Samples X
Split Samples __
Performance Evaluation Samples __

8.B. Laboratory Quality Control Samples:

Method Blank X
Matrix Duplicate/Replicate (Matrix Spike Duplicates) X
Matrix Spike X
Surrogate Spikes X
Other (specify) __

---

9. Other: Please provide any other germane information that may impact the data quality or gathering of this particular objective, task or data use.

1. Data use will include evaluation of health and environmental risks posed by surface water contamination.

2. ASL D samples are confirmational samples.

APPENDIX B

EQUIPMENT LIST

COMMON EQUIPMENT USED IN SAMPLING ACTIVITIES

Surface Soil and Waste Material Collection

- Vehicles
- Personnel Equipment
  - Steel Toed Boots
  - Safety Glasses
  - Cotton or Leather Palm Gloves

- Personnel Protective Equipment
  - Cloth Coveralls
  - Nitrile Gloves
  - Latex Boot Covers
  - Disposable Coveralls (where deemed necessary by IH)

- Sampling Equipment
  - Stainless Steel Hand Augers
  - 3-inch Diameter Bucket Heads
  - Extension
  - Handle
  - Stainless Steel Bowls
  - Stainless Steel Spoons
  - Stainless Steel Knives
  - Stainless Steel Trowels
  - Stainless Steel 3/8-inch Diameter Packing Rods
  - Tape Measure
  - Surveyor's Stakes
  - Flag Tape
  - Paper Towels
  - Plastic "Trash Bags/Sheet Plastic"
  - Container for Excess Soils (5-Gallon Bucket, Drum)
  - Deionized Water

- Sample Handling Equipment
  - Sample Jars, Amber or Glass
  - Chain of Custody Tape
  - Labels
  - Clear Tape
  - Blue Ice
  - Coolers

- Field Screening Instrumentation
  - Hnu Photoionization Detector
  - Beta/Gamma Frisker

Alpha Frisker
Munsell Soil Color Chart

Sub-Surface Soil Material Collection

Vehicles
Auger Drilling Rig

Personnel Equipment
- Steel Toed Boots
- Safety Glasses
- Cotton or Leather Palm Gloves

Personnel Protective Equipment
- Cloth Coveralls
- Nitrile Gloves
- Latex Boot covers
- Disposable Coveralls (where deemed necessary by IH)
- Hard Hat
- Hearing Protection

Sampling Equipment (Hand Augering 0 to 5 feet)
- Stainless Steel Hand Augers
- 3-inch Diameter Bucket Heads
- Extensions
- Handle
- Stainless Steel Bowls
- Stainless Steel Spoons
- Stainless Steel Knives
- Stainless Steel 3/8-inch Diameter Packing Rod
- Tape Measure
- Surveyor's Stakes
- Flag Tape
- Paper Towels
- Plastic "Trash Bags/Sheet Plastic"
- Container for Excess Soils (5 Gallon Bucket, Drum)
- Deionized Water

Sampling Equipment (Auger Rig)
- Auger Rig with 140 Pound Drop Weight
- 2-inch to 3-inch Inside Diameter Split spoon
- 12-inch nominal diameter bucket auger
- 55 Gallon Drum for Cuttings
- Caution Tape

Sample Handling Equipment
- Sample Jars, Amber or Clear Glass
- Chain of Custody Tape
- Labels
- Clear Tape
- Blue Ice
- Coolers

Field Screening Instrumentation
- Hnu Photoionization Detector
- Beta/Gamma Frisker
- Alpha Frisker
- Munsell Soil Color Chart

Groundwater Collection

Vehicles

Personnel Equipment
- Steel Toed Boots
- Safety Glasses

Personnel Protective Equipment
- Cloth Coveralls
- Nitrile gloves
- Saranex (as required by IH/Radiological Safety)

Sampling Equipment
- 1 Liter Teflon Bailers
- Rope
- Submersible Pump
- Tubing, Teflon
- Generator
- 5-gallon Bucket/55 gallon Drum

Sample Handling Equipment
- Sample Jars, Amber Glass, Plastic
- Filter Pump
- Filter Tubing, Teflon
- Filter, 0.45 Micron
- Chain of Custody Tape
- Labels
- Clear Tape
- Blue Ice

Coolers

Field Screening Instruments
- Hnu Photoionization Detector
- Beta/Gamma Frisker
- pH Meter
- Conductivity Meter
- Thermometer
- Dissolved Oxygen Meter

Surface Water Collection

Vehicles

Personnel Equipment
- Steel Toed Boots
- Safety Glasses

Personnel Protective Equipment
- Cloth Coveralls
- Nitrile Gloves
- Saranex (as required by IH/Rad Safety)
- Rubber Boots/Boot Covers

Sampling Equipment
- 1 Liter Grab Bottle, Plastic, Glass
- Composite Container, Plastic, Glass
- Plastic Sheeting
- Paper Towels

Sample Handling Equipment
- Sample Jars, Amber Glass, Plastic
- Filter Pump
- Filter Tubing, Teflon
- Filter, 0.45 Micron
- Chain of Custody Tape
- Labels
- Clear Tape
- Blue Ice
- Coolers

Field Screening Instrumentation
- Beta/Gamma Frisker
- pH Meter

APPENDIX C

EXAMPLE FIELD FORMS

Personal Protective Equipment (PPE)

1. Hard hat
2. Safety glasses
3. Steel-toed boots
4. Latex booties
5. Gloves
   a. Latex
   b. Nitrile
   c. Leather
6. Tyvek or Saranex suits
7. Full face respirator - optional depending on the area

Other Supplies and Equipment

1. Munsell Color Chart
2. Pocket penetrometer
3. Hand auger handle and tips (optional)
4. Two crescent wenches (optional)
5. Stainless steel butter knives (optional)
6. Two-way radio
7. Metal or plastic clipboard
8. Two plastic decon tubs
9. Two scrub brushes - also small bottle brush or tooth brush
10. Alconox soap
11. Paper towels
12. Roll of plastic and several plastic bags
13. Deionized water with bottle pump sprayer

FERNALD

RI/FS

FIELD ACTIVITY DAILY LOG

DAILY LOG				
DATE				
NO.				
SHEET		OF		

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
PERSONNEL ON SITE:	
SUPERVISOR:	DATE:

ASI FORM 0155A Rev (1) 9/01/92

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ERNALD
VFS

VISUAL CLASSIFICATION OF SOILS

6484

ROJECT NUMBER:	PROJECT NAME:	
ING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time:	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time:	DATE COMPLETED:
DRILLING METHODS		PAGE OF

DEPTH ( )	SAMPLE TYPE AND No.	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS

NOTES

ASI FORM 0158A REV. (1)

000140

FERNALD
RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME ______ FIELD ENG./GEO. ______ DATE ______
PROJECT NO. ______ CHECKED BY ______ DATE ______
BORING NO. ______
PIEZOMETER NO. ______ DATE OF INSTALLATION ______

BOREHOLE DRILLING

DRILLING METHOD ______	TYPE OF BIT ______
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID ______ FROM ______ TO ______	SIZE ______ FROM ______ TO ______
FLUID ______ FROM ______ TO ______	SIZE ______ FROM ______ TO ______

PIEZOMETER DESCRIPTION

TYPE ______	RISER PIPE MATERIAL ______
DIAMETER OF PERFORATED SECTION ______	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. ______ I.D. ______
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS ______
AVERAGE SIZE OF PERFORATIONS ______	JOINING METHOD ______
TOTAL PERFORATED AREA ______	______

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH ______	OTHER PROTECTION ______
PROTECTIVE PIPE O.D. ______	______

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE				
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE				
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP	BOTTOM	TOP	BOTTOM
BENTONITE	TOP	BOTTOM	TOP	BOTTOM
SAND	TOP	BOTTOM	TOP	BOTTOM
GRAVEL	TOP	BOTTOM	TOP	BOTTOM
PERFORATED SECTION	TOP	BOTTOM	TOP	BOTTOM
PIEZOMETER TIP				
BOTTOM OF BOREHOLE				
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐
REMARKS ______

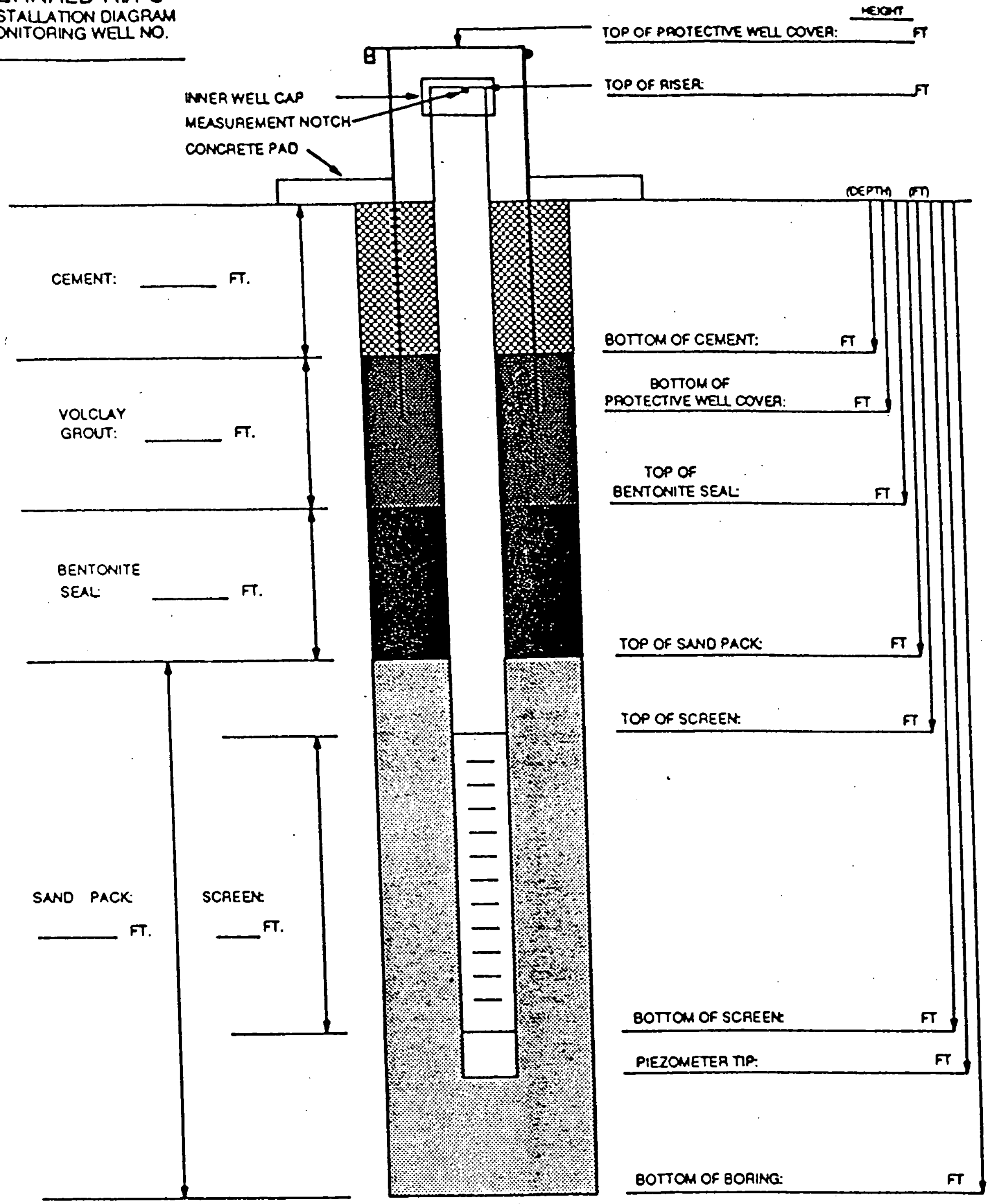
409-11

000141

6484

FERNALD RI/FS
INSTALLATION DIAGRAM
MONITORING WELL NO. ____________

INSTALLATION DATE: ____________



BOREHOLE DIAMETER: ______ IN.

MATERIALS USED	NOTES:	
SAND TYPE AND QUANTITY: ______	1) RISER PIPE IS ______ IN. ID. 316 STAINLESS STEEL PIPE, FLUSH-THREADED JOINTS.	4) WATER DEPTH AND DATE ______ FT/______
BENTONITE PELLETS (5-GALLON BUCKETS): ______	2) SCREEN IS ______ IN. ID. 316 STAINLESS STEEL PIPE WITH 0.______ IN. SLOTS.	5) TOP OF CASING IS SECURED WITH A STAINLESS STEEL CAP.
BAGS OF VOLCLAY GROUT: ______	3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.	6) PARENTHESIS INDICATE DEPTH BELOW GROUND LEVEL.
AMOUNT OF CEMENT: ______	GEOLOGIST/ENGINEER: ______	7) WELL CASING HAS A PROTECTIVE COVER WITH PADLOCK.
AMOUNT OF WATER USED: ______		
OTHER: ______		
TASK: ______		

ASI FORM 0157 REV. (0)

FERNALD RI/FS
PROJECT NO. 602
TASK 3.2

MONITORING WELL DEVELOPMENT

PAGE ___ OF ___

WELL NUMBER ___

DATE(S) OF WELL INSTALLATION ___

WELL DEVELOPMENT START DATE/TIME ___ COMPLETION DATE/TIME ___

		BEFORE DEVELOPMENT	AFTER DEVELOPMENT
STATIC WATER LEVEL			
DEPTH OF OPEN HOLE			
CHANGES IN PHYSICAL CHARACTER OF WATER REMOVED	TURBIDITY		
	COLOR		
	PARTICULATES		
	ODOR		

TOTAL CALCULATED VOLUME OF WATER TO BE REMOVED (IN GALLONS) ___

TOTAL VOLUME OF WATER ACTUALLY REMOVED DURING DEVELOPMENT (GALLONS) ___

TYPE AND SIZE OF PUMP ___ TYPE AND SIZE OF BAILER ___

PHYSICAL CHARACTER OF REMOVED SEDIMENTS (LITHOLOGY AND GRAIN SIZE)

DESCRIPTION OF SURGE TECHNIQUES (IF USED)

METER CALIBRATION

pH TEMP	pH STD.	pH STD.	SPECIFIC CONDUCT.	UMHOS/ CM	UMHOS/ CM	TURBIDITY NTU	TURBIDITY NTU

METER MODEL/ SERIAL NO.	pH METER	SPECIFIC CONDUCTANCE METER	TURBIDITY METER	DISSOLVED OXYGEN METER

FIELD ENGINEER/GEOLOGIST ___ DATE ___

DRILLER/HELPER ___

CHECKED/VERIFIED BY ___ DATE ___

MWDEV (2/88)

DATE AND TIME SAMPLE COLLECTED	GALLONS OF WATER PURGED FROM WELL	TEMP.	SPECIFIC CONDUCTANCE	pH	DO	TURBIDITY	REMARKS

REMARKS/OBSERVATIONS

MWDEV2 (2/88)

DATE AND TIME SAMPLE COLLECTED	GALLONS OF WATER PURGED FROM WELL	TEMP.	SPECIFIC CONDUCTANCE	pH	DO	TURBIDITY	REMARKS

REMARKS/OBSERVATIONS

FORM 0155C2 Rev. (0)

ERNALD RVFS
ROJECT NO. 602
ASK:

MONITORING WELL DEVELOPMENT

(Example)

PAGE ___ OF ___

WELL NUMBER ______________

DATE(S) OF WELL INSTALLATION ______________

WELL DEVELOPMENT START DATE/TIME ______________ COMPLETION DATE/TIME ______________

		BEFORE DEVELOPMENT	AFTER DEVELOPMENT
STATIC WATER LEVEL			
DEPTH OF OPEN HOLE			
CHANGES IN PHYSICAL CHARACTER OF WATER REMOVED	TURBIDITY		
	COLOR		
	PARTICULATES		
	ODOR		

TOTAL CALCULATED VOLUME OF WATER TO BE REMOVED (IN GALLONS) ______________

TOTAL VOLUME OF WATER ACTUALLY REMOVED DURING DEVELOPMENT (GALLONS) ______________

TYPE AND SIZE OF PUMP ______________ TYPE AND SIZE OF BAILER ______________

PHYSICAL CHARACTER OF REMOVED SEDIMENTS (LITHOLOGY AND GRAIN SIZE)

DESCRIPTION OF SURGE TECHNIQUES (IF USED)

METER CALIBRATION

pH TEMP	pH STD	pH STD	SPECIFIC CONDUCT.	uMHOS/ CM	uMHOS/ CM	TURBIDITY NTU	TURBIDITY NTU

METER MODEL/ SERIAL NO.	pH METER	SPECIFIC CONDUCTANCE METER	TURBIDITY METER	DISSOLVED OXYGEN METER

FIELD ENGINEER/GEOLOGIST ______________ DATE ______________

DRILLER/HELPER ______________

CHECKED/VERIFIED BY ______________ DATE ______________

ASI FORM 0155C Rev (1) 9/01/92

(CONTINUED ON REVERSE)

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FERNALD
RI/FS

WATER QUALITY FIELD COLLECTION REPORT

Date: ______
Time: ______
Page: ____ of ____

FADL REF # ______

PROJECT NAME		SAMPLE LOCATION	
PROJECT NUMBER		SAMPLE ID NUMBER	
DATE COLLECTED		RFA NUMBER	
TIME COLLECTED		C/C NUMBER	
COLLECTED BY		SAMPLE TYPE	

SAMPLING INFORMATION

BAROMETRIC PRESSURE	
AIR TEMPERATURE	
DO SATURATION IN AIR	
WATER TEMPERATURE	
DEPTH OF SAMPLE	
WATER LEVEL	

FIELD READINGS

	BEGINNING READ 1	MIDDLE READ 2	END READ 3
pH			
SPEC. COND. uMHOS/cm			
D.O. MG/L			

	BACKGROUND	BREATHING ZONE	DOWNHOLE READING
HNU			

METER CALIBRATION

pH Temp.	pH Std.	pH Std.	D.O. Temp.	D.O. Zero	D.O. Full Sc.	D.O. Calib. O_2	Spec. Cond. Temp.	Spec. Cond. Low	Spec. Cond. High	HNU Stand	HNU Lot #	HNU Span	HNU Reading
	4	7						147	1413				
OK			OK				OK						

WEATHER CONDITIONS	
ADDITIONAL REMARKS	

TEST EQUIPMENT LIST

EQUIPMENT NUMBER	EQUIPMENT NAME

EQUIP.	NUMBER
BAILER	
HOSE/S	
PUMP	
FILTER KIT	

NOTE: ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED

(T.D. ____) - (W.L. ____) = ____ Ht. of Water Column

____ Ht. of Water Column x ____ = ____ (3 Volumes)

____ Ht. of Water Column x ____ = ____ (5 Volumes)

000147

DATE:	
TIME	
PAGE ___ OF ___	
PAGE:	

FERNALD
RI/FS

PIEZOMETER SENSITIVITY TEST

PROJET NAME_______________________TESTED BY________________DATE__________

PROJECT NO.________________________

BORING NO. ________________________

PIEZOMETER NO. ____________________

TEST TRIAL NO. ____________________

GWL BELOW TOP OF PIPE PRIOR TO TEST ________________(M-scope, 0.01 foot accuracy)

TIME READING TAKEN ______________________________

THE PIEZOMETER WAS FILLED WITH WATER. THE FOLLOWING DATA SHOW THE DROP OF WATER FROM THE TOP OF THE PIPE AS TIME ELAPSED.

ELAPSED TIME (MINUTES)	DROP OF WATER (FEET)

BASED ON THE ABOVE DATA, IT IS CONCLUDED THAT THE PIEZOMETER IS:

__________FUNCTIONING PROPERLY

__________NOT FUNCTIONING PROPERLY

FERNALD
RI/FS

PAGE ___ OF ___
PAGE

PIEZOMETER DATA SHEET

(1) DEPTH TO THE WATER LEVEL FROM THE TOP OF PIPE
(2) ELEVATIONS SHOWN ARE TOP OF PIEZOMETER PIPE

PROJECT NAME ____________________ PROJECT NO. __________

DATE & RECORDER	PIEZOMETER READINGS - FEET (1)										ELEVATION OF WATER LEVEL - FEET
	# EL.(2)	# EL.	# EL.	# EL.	# EL	# EL.	# EL.	# EL.	# EL.	# EL	# EL.

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FERNALD
RI/FS

REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY RECORD

Reference Document No.________
Page 1 of ______

PROJECT/TASK NAME ____________
PROJECT/TASK NO. ____________
PROJECT MANAGER ____________
SAMPLE TEAM MEMBERS ____________
PROJECT CONTACT ____________
PHONE NUMBER ____________
CRU NUMBER ____________

DATE SAMPLES SHIPPED ____________
CARRIER/WAYBILL NUMBER ____________
LAB DESTINATION ____________
LABORATORY CONTACT ____________
DATE REPORT REQUIRED ____________
PURCHASE ORDER NUMBER ____________

BILL TO: FERMCO/Procurement
P.O. Box 398704
Cincinnati, OH 45239

ORIGINAL DATA REPORT: Ebasco Environmental Services Attn.: Data Validation
4996 Bradenton Ave., Suite 130
Dublin, OH 43017

SAMPLE NUMBER	SAMPLE LOCATION AND DESCRIPTION	DEPTH	DATE	TIME	SAMPLE TYPE	NO. OF CNTNRS.	SAMPLE VOLUME (each)	CONTAINER TYPE	PRESERV-ATIVE	TAL NUMBER	REQUESTED ANALYSES	CLP Pkg.	PAT ITEM	HWMU	RELEASE NUMBER	CONDITION ON RECEIPT (INITIALS AND DATE)

NOTE: If more than 11 lines are needed for one sample number, use a separate RFA/CC for the remaining sample parameters. Special Instructions:

Possible Sample Hazards: ☐ Radionuclides ☐ Volatile Organics
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐

Sample Disposal:
Return to Client ☐ Disposal by Lab ☐

Turnaround Time Required
Normal ☐ Rush ☐

1. Relinquished by (Name, Company, Date, Time)	1. Received by (Name, Company, Date, Time)
2. Relinquished by (Name, Company, Date, Time)	2. Received by (Name, Company, Date, Time)
3. Relinquished by (Name, Company, Date, Time)	3. Received by (Name, Company, Date, Time)

Comments:

...dination ______ Field Review ________ Date ________ / QA Review ________ ...te ________

SAMPLE COLLECTION LOG

UNIQUE SAMPLE NUMBER	SAMPLE LOCATION	COLLECTOR INITIALS	COLLECTION DATE			COLLECTION TIME		COORDINATES		SAMPLE DEPTH INTERVAL	SAMPLE TYPE	SAMPLE MEDIA	PRESERVATIVE	SEQUENCE	BLANK	SPIKE	DUPLICATE	DUPLICATE OF SAMPLE NUMBER	SPLIT	SPLIT OF SAMPLE NUMBER	INITIAL
			MO	DY	YR	HR	MIN	NORTH	EAST												

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FMPC RI/FS

VR No. ______

VARIANCE REQUEST

Page ___ of ___

Date: ________

VARIANCE (Include Justification)

REQUESTED BY: ________________ Date: __________

APPROVED BY: ________________________ Date: __________

Project Director/Designee

________________________ Date: __________

Project Quality Assurance Officer

APPLICABLE DOCUMENT(S) AND SECTION No.(S)

FERNALD
RI/FS

VARIANCE LOG

PROJECT NUMBER ______________________ PAGE _____ OF _____

PROJECT NAME ______________________

DATE	VARIANCE GRANTED AND APPLICABLE DOCUMENT	RESPONSIBLE INDIVIDUAL

401-11-86

FERNALD
RI/FS

NONCONFORMANCE REPORT

PROJECT NO. ____________ PAGE ___ OF ___

PROJECT NAME ______________________ DATE: ________

NONCONFORMANCE:

IDENTIFIED BY: ______________ DATE: ________

CORRECTIVE ACTION REQUIRED:

TO BE PERFORMED BY: ______________________ DATE: ________

MUST CORRECTION BE VERIFIED? YES ___ NO ___

TO BE VERIFIED BY: ________ PREPARED BY: ____________ DATE: ________

CORRECTIVE ACTION TAKEN:

PERFORMED BY: ______________ DATE: ________

VERIFIED BY: ______________ DATE: ________

CC:

Approved By: ______________ Date: ________

______________ Date: ________

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DATE	
TIME	
PAGE ___ OF ___	
PAGE	
Chkd. By ___	

FERNALD RI/FS

Surface Measurements Field Logbook Form

Site: ____________ Surveyors: ____________

Area: ____________ Recorded By: ____________

Date: ____________ Count Time: ____________ Background: ____________ CPM

____________ CPM

(-X)W←←←←←Coordinates→→→→→E(+X)

(-Y)S ←←←←Coordinates→→→→→N(+Y)

Comments: ____________

Scaler Model ________ Serial No. ________

Probe Model ________ Serial No. ________

Scaler Model ________ Serial No. ________

Probe Model ________ Serial No. ________

PIC Serial No. ________

PAGE ____ OF ____					
PAGE					

FERNALD
RI/FS

Shielded Delta-Gamma In-Situ Measurement

Background Assessment

Project Name: ______________________ Recorded By: ______________________

Date: ______________________ Time: ______________________

Delta Housing No.: ______________________ Daily Check Results: ______________________

Probe No.: ______________________ HV __________(1000V) Threshold __________(100)

Ratemeter/Scaler No.: ______________________ BAT __________(OK) Window __________(OUT)

Check Source No.: ______________________ Check Location: ______________________

Unchielded C_1* __________ C_2 __________ C_3 __________ Avg. Unshielded __________

Shielded C_1* __________ C_2 __________ C_3 __________ Avg. Shielded __________

Delta 1 __________ 2 __________ 3 __________ Avg. Delta __________

Bkg. Meas.	Location	Unshielded C_1*	Unshielded C_2	Unshielded C_3	Shielded C_1*	Shielded C_2	Shielded C_3	Delta
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Average ______________________

Std. Dev. ______________________

Ave. ± 3 Std. Dev. ______________________

*Each count represents the counts per minute based on integration of 1000 cts. on the "C" scale of a ratemeter/scaler.

DATE						
TIME						
PAGE ___ OF ___						
PAGE						

FERNALD
RI/FS

Shielded Delta-Gamma In-Situ Measurements
Field Radiation Measurements

Project Name: ____________________ Recorded By: ____________________

Shield Id. No.: ____________________ Calibration Factor: ____________________

Probe No.: ____________________ Comments: ____________________

Ratemeter/Scaler No.: ____________________

Surveyors: ____________________

Field Measurements

Measurement N-S	Location E-W	Unshielded Counts (CPM) C_1	C_2	C_3	Shielded Counts (CPM) C_1	C_2	C_3	Average Delta	Location For Further Consideration Yes	No

WEEKLY CALIBRATION LOG GROUNDWATER

I.D. NUMBER	EQUIPMENT	CREW

Date: Initials: **METER CALIBRATION**

pH Temp.	pH Std.	pH Std.	D.O. Temp.	Zero	Full Sg	D.O. Calib. O_2	Spec. Cond. Temp.	Spec. Cond. Low	Spec. Cond. High	HNU Stand.	HNU Lot #	HNU Reading	HNU Span
	4	7						147	1413				
OK			OK				OK						

Date: Initials: **METER CALIBRATION**

pH Temp.	pH Std.	pH Std.	D.O. Temp.	Zero	Full Sg	D.O. Calib. O_2	Spec. Cond. Temp.	Spec. Cond. Low	Spec. Cond. High	HNU Stand.	HNU Lot #	HNU Reading	HNU Span
	4	7						147	1413				
OK			OK				OK						

Date: Initials: **METER CALIBRATION**

pH Temp.	pH Std.	pH Std.	D.O. Temp.	Zero	Full Sg	D.O. Calib. O_2	Spec. Cond. Temp.	Spec. Cond. Low	Spec. Cond. High	HNU Stand.	HNU Lot #	HNU Reading	HNU Span
	4	7						147	1413				
OK			OK				OK						

Date: Initials: **METER CALIBRATION**

pH Temp.	pH Std.	pH Std.	D.O. Temp.	Zero	Full Sg	D.O. Calib. O_2	Spec. Cond. Temp.	Spec. Cond. Low	Spec. Cond. High	HNU Stand.	HNU Lot #	HNU Reading	HNU Span
	4	7						147	1413				
OK			OK				OK						

TA7740.k12

Fernald RI/FS
Health and Safety Procedures

Title: Use, Calibration, and Maintenance of the HNU PI-101

Procedure #: HS 015 Issued: ____________

APPENDIX 10.2

HNU PI-101
MAINTENANCE AND CALIBRATION LOG

Instrument Serial #: ______ Last Factory Calibration: _____

UV Light Source Cleaned*: ____________________
Date

Ionization Chamber Cleaned*: ____________________
Date

Calibration Procedure (1 or 2): ____________________

Inspected by: ____________ Date: ____________

-- Source: ____________________

-- Type: ____________________

-- Concentration: ____________________

-- Lot #: ____________________

Results of Calibration:

-- Span setting: initial ________ final ________

-- Probe: ____________________

-- Instrument reading (ppm): initial ________ final ________

Results within ± 15% of calibration gas concentration: _____

COMMENTS: ____________________

____

____

Calibrated by: ____________ Date: ____________

*Due Monthly

TITLE: Walk-Over Surveys Using a Large Volume Scintillation Detector	NO: RSL-2003
	REVISION: 1

LARGE VOLUME SCINTILLATION DETECTOR

INSTRUMENT CHECK
PROCEDURE RSL-2003

Scaler Model ____________ Serial No. ____________

Detector Model ____________ Serial No. ____________

Date	Battery Response	Bkgd (cpm)	Cesium Check Source (cpm)	Americium Check Source (cpm)	Surveyor's Initals

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INSTRUMENT BASELINE DATA SHEET

Instrument Model:	Serial Number:	Cal. Due Date:
Check Source:	Source ID #:	Cal. Frequency:
Storage Location:	Inst. Coordinator Check Freq.:	User Check Frequency:

Date	Visual Ck.	Battery Ck.	Background	Source Value	Inst. Reading	Efficiency	Control Band	

Comments:		
Shipped To:	Dated Shipped:	Reason: ☐ Cal. ☐ Repair

ASI Form 0114 Rev. (0) 2/92

APPENDIX D

TAL LISTS

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

JROPUNCH WATER AND SOIL SAMPLES TO FERMCO LAB

TAL 20.03.05 A

FEMP RI/FS – RADIOLOGICAL – ANALYTICAL PARAMETERS

RADIOLOGICAL

1		Total Uranium

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

C 'NDWATER, SURFACE WATER SAMPLES

TAL 20.03.05 B

FEMP RI/FS – FULL HSL – ANALYTICAL PARAMETERS

INORGANICS

		Pay Item
1	Aluminum	
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	50
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

VOLATILE ORGANICS

		Pay Item
1	1,1–Dichloroethane	
2	1,1–Dichloroethene	
3	1,1,1–Trichloroethane	
4	1,1,2–Trichloroethane	
5	1,1,2,2–Tetrachloroethane	
6	1,2–Dichloroethane	
7	1,2–Dichloroethene (total)	
8	1,2–Dichloroethylene	
9	1,2–Dichloropropane	
10	2–Butanone	
11	2–Hexanone	
12	4–Methyl–2–pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	47
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis–1,3–Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans–1,3–Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
	Vinyl chloride	

SEMIVOLATILE ORGANICS

		Pay Item
1	1,2–Dichlorobenzene	
2	1,2,4–Trichlorobenzene	
3	1,3–Dichlorobenzene	
4	1,4–Dichlorobenzene	
5	2–Chloronaphthalene	
6	2–Chlorophenol	
7	2–Methylnaphthalene	
8	2–Methylphenol	
9	2–Nitroaniline	
10	2–Nitrophenol	
11	2,4–Dichlorophenol	
12	2,4–Dimethylphenol	
13	2,4–Dinitrophenol	
14	2,4–Dinitrotoluene	
15	2,4,5–Trichlorophenol	
16	2,4,6–Trichlorophenol	
17	2,6–Dinitrotoluene	
18	3–Nitroaniline	
19	3,3'–Dichlorobenzidine	
20	4–Bromophenyl phenylether	
21	4–Chloro–3–methylphenol	
22	4–Chloroaniline	
23	4–Chlorophenyl–phenyl ether	
24	4–Methylphenol	
25	4–Nitroaniline	
26	4–Nitrophenol	
27	4,6–Dinitro–2–methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	52
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2–Chloroethoxy)methane	
39	bis(2–Chloroethyl)ether	
40	bis(2–Chloroisopropyl) ether	
41	bis(2–Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di–n–butyl phthalate	
50	Di–n–octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3–cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N–Nitroso–di–n–propylamine	
62	N–Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

PESTICIDES / PCBs

		Pay Item
1	4,4'–DDD	
2	4,4'–DDE	
3	4,4'–DDT	
4	Aldrin	
5	alpha–BHC	
6	alpha–Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta–BHC	49
15	delta–BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan–I	
19	Endosulfan–II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma–BHC	
24	gamma–Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

FEMP RI/FS – GENERAL GROUND WATER QUALITY – ANALYTICAL PARAMETERS

GENERAL CHEMISTRY

1	Alkalinity	
2	Ammonia	
3	Chloride	
4	Fluoride	
5	Nitrate	
6	Phenols	143
7	Phosphate	
8	Sulfate	
9	Sulfide	
10	Total Organic Carbon (TOC)	
11	Total Organic Halogens (TOX)	
12	Total Organic Nitrogen (TON)	

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

C NDWATER, SURFACE WATER SAMPLES

TAL 20.03.05 B

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

RADIOLOGICAL

		Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Uranium	
14	Uranium 234	
15	Uranium 235/236	
16	Uranium 238	

MISC. RADIOLOGICAL

		Pay Item
1	Gross alpha	19
2	Gross beta	
3	Total Thorium	116

)PERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

SLUDGE, AND WASTE SAMPLES

'AL 20.03.05 C

:MP RI/FS – FULL HSL – ANALYTICAL PARAMETERS

INORGANICS

		Pay Item
1	Aluminum	50
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

VOLATILE ORGANICS

		Pay Item
1	1,1–Dichloroethane	47
2	1,1–Dichloroethene	
3	1,1,1–Trichloroethane	
4	1,1,2–Trichloroethane	
5	1,1,2,2–Tetrachloroethane	
6	1,2–Dichloroethane	
7	1,2–Dichloroethene (total)	
8	1,2–Dichloroethylene	
9	1,2–Dichloropropane	
10	2–Butanone	
11	2–Hexanone	
12	4–Methyl–2–pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis–1,3–Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans–1,3–Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
	Vinyl chloride	

SEMIVOLATILE ORGANICS

		Pay Item
1	1,2–Dichlorobenzene	52
2	1,2,4–Trichlorobenzene	
3	1,3–Dichlorobenzene	
4	1,4–Dichlorobenzene	
5	2–Chloronaphthalene	
6	2–Chlorophenol	
7	2–Methylnaphthalene	
8	2–Methylphenol	
9	2–Nitroaniline	
10	2–Nitrophenol	
11	2,4–Dichlorophenol	
12	2,4–Dimethylphenol	
13	2,4–Dinitrophenol	
14	2,4–Dinitrotoluene	
15	2,4,5–Trichlorophenol	
16	2,4,6–Trichlorophenol	
17	2,6–Dinitrotoluene	
18	3–Nitroaniline	
19	3,3'–Dichlorobenzidine	
20	4–Bromophenyl phenylether	
21	4–Chloro–3–methylphenol	
22	4–Chloroaniline	
23	4–Chlorophenyl–phenyl ether	
24	4–Methylphenol	
25	4–Nitroaniline	
26	4–Nitrophenol	
27	4,6–Dinitro–2–methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2–Chloroethoxy)methane	
39	bis(2–Chloroethyl)ether	
40	bis(2–Chloroisopropyl) ether	
41	bis(2–Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di–n–butyl phthalate	
50	Di–n–octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3–cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N–Nitroso–di–n–propylamine	
62	N–Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

PESTICIDES / PCBs

		Pay Item
1	4,4'–DDD	49
2	4,4'–DDE	
3	4,4'–DDT	
4	Aldrin	
5	alpha–BHC	
6	alpha–Chlordane	
7	Aroclor 1016	
8	Aroclor 1221	
9	Aroclor 1232	
10	Aroclor 1242	
11	Aroclor 1248	
12	Aroclor 1254	
13	Aroclor 1260	
14	beta–BHC	
15	delta–BHC	
16	Dieldrin	
17	Endosulfan sulfate	
18	Endosulfan–I	
19	Endosulfan–II	
20	Endrin	
21	Endrin aldehyde	
22	Endrin ketone	
23	gamma–BHC	
24	gamma–Chlordane	
25	Heptachlor	
26	Heptachlor epoxide	
27	Methoxychlor	
28	Toxaphene	

FEMP RI/FS – FULL RADIOLOGICAL – ANALYTICAL PARAMETERS

RADIOLOGICAL

		Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Uranium	
14	Uranium 234	
15	Uranium 235/236	
16	Uranium 238	

MISC. RADIOLOGICAL

		Pay Item
1	Gross alpha	19
2	Gross beta	
3	Total Thorium	116

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OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

GEOTECHNICAL TESTING

TAL 20.03.05 D

FEMP RI/FS - GEOTECHNICAL - ANALYTICAL PARAMETERS

	GEOTECHNICAL	Pay Item
1	Specific Gravity	81
2	Water/Moisture Content	72
3	Dry Weight	–
4	Liquid Limit	75 •
5	Plastic Limit	
6	Particle Size – Hydrometer	79
7	Sieve Analysis	71

• Atterberg Limits – ASTM D 4318-84

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

MPLES TO BE TESTED FOR CONSOLIDATION

TAL 20.03.05 E

FEMP RI/FS - GEOTECHNICAL - ANALYTICAL PARAMETERS

	GEOTECHNICAL	Pay Item
1	One Dimensional Consolidation	93

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

'DRAULIC CONDUCTIVITY SAMPLES

TAL 20.03.05 F

FEMP RI/FS - GEOTECHNICAL - ANALYTICAL PARAMETERS

	GEOTECHNICAL	Pay Item
1	Permeability (Constant Head)	63

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

OTECHNICAL TESTING

TAL 20.03.05 G

FEMP RI/FS – GEOTECHNICAL – ANALYTICAL PARAMETERS

		GEOTECHNICAL	Pay Item
1		Unconfined Compressive Strength	97
2		Direct Shear – Slow	95
3		CU Triaxial (3 pts)	99

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

YASH SAMPLES

TAL 20.03.05 H

FEMP RI/FS - TCLP - ANALYTICAL PARAMETERS *

INORGANICS

		Pay Item
1	Arsenic	2
2	Barium	
3	Cadmium	
4	Chromium	
5	Lead	
6	Mercury	
7	Selenium	
8	Silver	

VOLATILE ORGANICS

		Pay Item
1	1,1-Dichloroethene	4
2	1,2-Dichloroethane	
3	2-Butanone	
4	Benzene	
5	Carbon tetrachloride	
6	Chlorobenzene	
7	Chloroform	
8	Tetrachloroethene	
9	Trichloroethene	
10	Vinyl chloride	

SEMIVOLATILE ORGANICS

		Pay Item
1	1,4-Dichlorobenzene	7
2	2-Methylphenol	
3	2,4-Dinitrotoluene	
4	2,4,5-Trichlorophenol	
5	2,4,6-Trichlorophenol	
6	3-Methylphenol	
7	4-Methylphenol	
8	Hexachlorobenzene	
9	Hexachlorobutadiene	
10	Hexachloroethane	
11	Nitrobenzene	
12	Pentachlorophenol	
13	Pyridine	

HERBICIDES

		Pay Item
1	2,4-D	11
2	2,4,5-TP	

PESTICIDES

		Pay Item
1	alpha-Chlordane	9
2	Endrin	
3	gamma-BHC	
4	gamma-Chlordane	
5	Heptachlor	
6	Heptachlor epoxide	
7	Methoxychlor	
8	Toxaphene	

* In addition to TCLP parameters, complete TCLP Full Extraction Only (Pay Item 122)

OPERABLE UNIT 2 WORK PLAN ADDENDUM, PHASE II RI/FS STUDY

MPLES FOR TOXICITY CHARACTERISTICS

TAL 20.03.05 J

FEMP RI/FS – TCLP – ANALYTICAL PARAMETERS *

INORGANICS

#	Parameter	Pay Item
1	Arsenic	2
2	Barium	
3	Cadmium	
4	Chromium	
5	Lead	
6	Mercury	
7	Selenium	
8	Silver	

MISC. ADD'L INORGANICS

#	Parameter	Pay Item
1	Copper	–
2	Iron	–
3	Manganese	–
4	Zinc	–

VOLATILE ORGANICS

#	Parameter	Pay Item
1	1,1-Dichloroethene	4
2	1,2-Dichloroethane	
3	2-Butanone	
4	Benzene	
5	Carbon tetrachloride	
6	Chlorobenzene	
7	Chloroform	
8	Tetrachloroethene	
9	Trichloroethene	
)	Vinyl chloride	

SEMIVOLATILE ORGANICS

#	Parameter	Pay Item
1	1,4-Dichlorobenzene	7
2	2-Methylphenol	
3	2,4-Dinitrotoluene	
4	2,4,5-Trichlorophenol	
5	2,4,6-Trichlorophenol	
6	3-Methylphenol	
7	4-Methylphenol	
8	Hexachlorobenzene	
9	Hexachlorobutadiene	
10	Hexachloroethane	
11	Nitrobenzene	
12	Pentachlorophenol	
13	Pyridine	

HERBICIDES

#	Parameter	Pay Item
1	2,4-D	11
2	2,4,5-TP	

PESTICIDES

#	Parameter	Pay Item
1	alpha-Chlordane	9
2	Endrin	
3	gamma-BHC	
4	gamma-Chlordane	
5	Heptachlor	
6	Heptachlor epoxide	
7	Methoxychlor	
8	Toxaphene	

*In addition to TCLP parameters, complete TCLP Full Extraction Only (Pay Item 122)

Conductivity Meter
Thermometer
Dissolved Oxygen Meter
Soil Gas Survey